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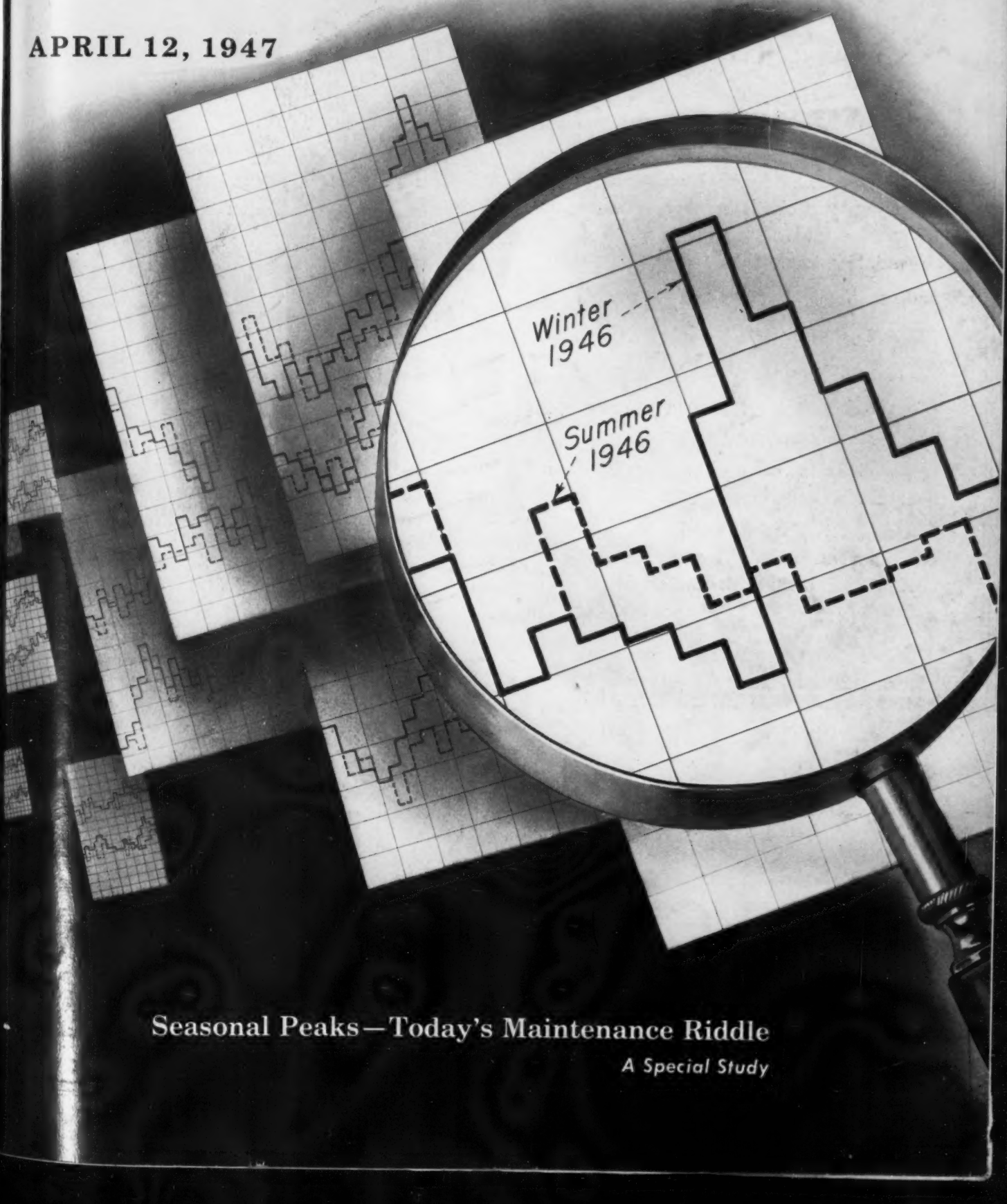

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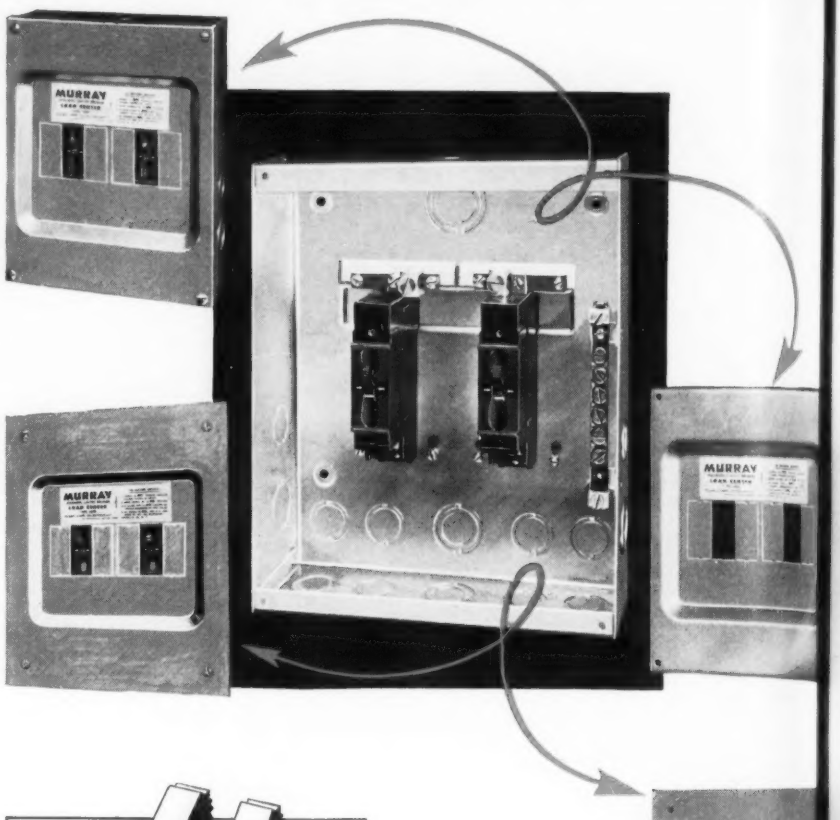

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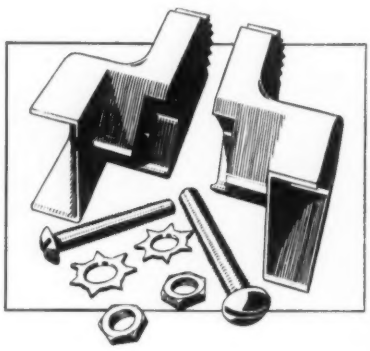

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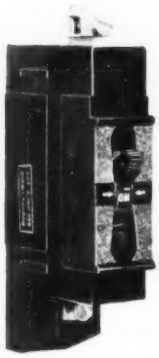

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April 12, 1947 — Vol. 127, No. 15

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OUR TEACHERS—

They Need The Help Of Business Now

THIS is an appeal to raise school teachers salaries—fast. Such appeals are commonly addressed, rather vaguely, to the conscience of the community. This one is not. It is addressed directly to the business community, and to its hard core of common sense.

As a whole, the school teachers of the nation are taking an economic beating. So, too, are their close associates and co-workers, the librarians. In purchasing power, public school teachers salaries, after taxes, average about 20 percent less than they did eight years ago. Beginning salaries of librarians, always low, have fallen behind an equal amount in purchasing power. College and university teachers are not much better off. The pressure is particularly heavy on those in the lower ranks. As a group, teachers and librarians are close to the bottom of the economic heap.

Unless this situation is remedied promptly, it is confidently to be expected that:

1. The more competent teachers will continue to desert our schools in droves, and our libraries will remain inadequately staffed. More than 350,000 teachers — many of them the very able ones—have left the public school teaching staff of about 900,000 in the last six years. More than 100,000 of the replacements are "substandard." They cannot meet the minimum educational requirements of their jobs which, by admission of the profession itself, are none too high.

2. Those who remain will be organized increasingly into economic pressure groups. Teachers strikes and the rapid growth of unionism among teachers at present clearly indicate what is in store.

Many business men are so deeply disturbed by the resort to the strike weapon by some teachers to enforce their salary demands that their sympathy for the general plight of our teachers tends to be dulled. Such an attitude is understandable. It avails nothing, however, in eliminating the crisis in education caused largely by teachers salary troubles.

The crisis in education is a crisis for the nation as a whole. The work of our schools, colleges and libraries is such that its deterioration means deterioration of the nation. However, the salary crisis in education is in special measure a crisis for the business community. That community has a special stake in having a well-educated and well-disposed constituency.

Education and Unionism

There may be room for disagreement as to whether teachers should organize themselves in trade unions, and follow trade union tactics. However, there is no conceivable room for disagreement as to whether organization of teachers into a fighting economic pressure group under the lash of a teachers salary crisis would be a body blow to business. Among many teachers it would foster an abiding hostility to the institution of business which, occupying a key position in the life of the community, had not done its utmost to make such unionization unnecessary by taking a lead in relieving the teachers salary crisis.

In our work of publishing technical periodicals and text books, we at McGraw-Hill meet and come to know many teachers and librarians. We know that, as a group, they have little appetite for participation in militant economic pressure groups. They are far more interested in making a militant assault on ignorance and prejudice through concentration on their professional work. If, through neglect of their economic needs by the business community, they feel forced to resort to trade union organization and tactics, the teachers and librarians can be expected to have an abiding re-

sentment toward the institution of business. That resentment will, in turn, be communicated in no small measure to the coming generation. Such is the nature of the educational process.

The crisis in education is not, of course, exclusively a matter of salaries. Unsatisfactory working conditions also play a part. Many schools are dilapidated and terribly overcrowded. So are some libraries. Some small-town school boards oppressively insist that the school teachers be the paragons of piety the board members wish they were themselves. Protection of a proper degree of academic freedom is sometimes missing. The teacher is rarely accorded a prestige comparable to the importance of the job. Elements such as these aggravate the crisis in education. But the first and absolutely essential step toward surmounting the crisis is to provide tolerable salaries.

Because of the enormous diversity of local conditions affecting teachers and librarians salaries, no general rule for emergency action would fit all cases. From state to state, average yearly expenditures on education in 1940 varied all the way from about $30 per pupil to about $150. Some states, like Nebraska, finance their schools almost exclusively from local taxes. Others, like Delaware, rely almost entirely on state taxes. Some states and communities have already acted to meet the salary crisis. Others have not. Variations such as these limit any generalization.

Guide for Emergency Action

But as a general proposition it can be safely said that the minimum requirements of the emergency will not have been met so long as the salaries of class room teachers and junior members of college faculties and library staffs have not been increased by the amount necessary to keep them abreast of the increase of about 50 percent in the cost of living since 1939. In many cases, a temporary cost of living adjustment might prove the best way to handle the problem.

This suggestion, let it be repeated, is not offered as a solution of the salary problem, but as a start. With their salaries increased enough to meet the increased cost of living, the teaching and library groups as a whole would still have cause to envy the current economic position of industrial workers. Since 1939, the average of weekly earnings of industrial workers after taxes, has outstripped the rise in the cost of living by about 21 percent.

However, a start and an absolutely essential start would be made toward giving America the sort of educational system it must have not only to fulfill its ideals but holds its own in this highly competitive world. We worry, and I think rightly, about having the free world engulfed by Russian Communism. According to the best figures available, the U.S.S.R. is spending about twice as large a share of its total national income for education as we are. The figures compared include our expenditures for both public and private education. That comparison is really something to worry about.

States Should Take Lead

In dealing with the salary crisis it is up to the teachers to display a maturity and integrity worthy of their profession. Teachers have many employment advantages, such as long vacations. They should not slur them over in making comparisons of their annual incomes. Also employment in teaching and libraries has been notably stable. Teachers and librarians should not ignore that fact in comparing their position with those whose employment has been far less steady.

At the same time, the great fiscal difficulties involved in solving the crisis in teachers and librarians salaries must not be used as an excuse for postponing effective action. The states are better equipped financially and otherwise to take such action than is the federal government and, with the localities directly involved, should take the lead. If the price of effective action is a heavier tax burden for communities already too heavily burdened that price must be paid. The crisis presents a major emergency. To handle it as anything less is to court irreparable damage to the nation as a whole, and a special measure of damage to business as well. The intelligent self-interest of business requires that it leave nothing undone to meet and master the crisis in education.

President McGraw-Hill Publishing Company, Inc.

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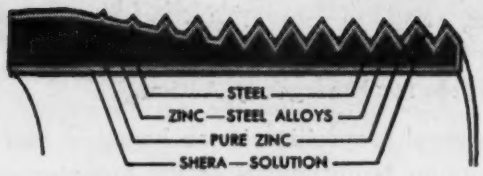

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Electrical World

APRIL 12, 1947

Toward Alternative Fuels

BEFORE THE FIRST World War, steam power plant operators quite largely had to find the grade of coal which would give best results on their grates or stokers. Between that period and the last war came pulverized coal and the intensified competition from oil and gas. In that era, plants were designed largely to use a certain coal or at least a distinct type of coal. Maturing experience later with pulverizers indicated limitations which led to numerous shifts to more successful grades and types of coal.

Coming of the Second World War posed a new issue to the owner of pulverized-coal-fired furnaces because he, as well as the steel industry, needed a higher-fusing-ash, low-sulphur coal. The lucky ones were those who had furnaces designed to function with the lower grade coals of the Middle West, including the strip-mined variety. Meanwhile, utility power plants have had to contend with increasing ash content in a period when generating capacity was crowded to the limit.

Add to these factors the disruptions in coal production, the transportation tie-ups, shipping shortages, etc., and one has the reason for switching fuels during unanticipated emergencies, often quickly and with considerable discomfiture. Some stations that never contemplated using oil had to do so during one or more of the emergencies. Fortunately, some stations had been designed for just that eventuality.

Whether this complexity and fluidity of the general fuel pattern has permanence or is merely a passing aspect is almost anybody's guess. But one thing is certain—that coal costs are permanently on a higher level and that oil may be less plentifully available along the eastern seaboard. On the assumption that present circumstances will never revert to the simpler pattern of prewar days, it appears desirable to shape the boilers, pulverizers, stokers, fuel tanks, hoppers, coal handling and ash handling so that the station can ride without distress through fairly extreme substitutions and perform well through a reasonable range of alternative fuels.

Preparing for the impromptu switch is thus no longer enough. The approach undoubtedly must be embracive enough to accommodate simultaneous or alternate use of the advantageous or available fuels as often as upsetting factors intervene. Meanwhile, cost alone is a compelling factor, not only because of wage increases at the mine, but because of increments that arise out of progressive depletion, stepped-up royalties, added welfare "taxes", allocations when stringencies arise, higher freight rates, weather hindrances, etc. It looks like an era ahead in which there will be more "shopping around" for fuels.

But there will be no point in "shopping around" unless the plants and the operator can use effectively and reasonably efficiently whatever fuel is economical and available at the time. Insofar as the apparatus is concerned, it should thus be versatile, convertible and adaptable and even as universal as can be, without spending undue money to meet an unlikely eventuality or without sacrificing too much in sustained performance efficiency.

NEWS OF THE

New Jersey Acts to Put Teeth in Anti-Strike Law That Failed

State Seizes Telephone System but Employees Stayed Away from Work—Indiana and Virginia Legislation Satisfactory —Washington Sentiment for Injunctive Laws Crystallizing

NEW JERSEY banned strikes in public utilities without a 60-day cooling-off period this week and instituted compulsory arbitration, after seizure, as the means of settling disputes which outlive the cooling-off period. Fines of $10,000 against utilities or unions which violate the act, plus daily fines of $250 to $500 or 30 days imprisonment against individuals, put penalties into the state's anti-utility-strike act hitherto unenforceable.

This hasty action followed a complete breakdown of the "Edge Act," first state law aimed specifically at maintaining utility service threatened by labor disputes. Invoked as the nation-wide telephone strike took effect Monday, the law proved valueless in keeping employees on their jobs even though facilities of New Jersey Bell Telephone were seized by the state.

Elsewhere, Indiana and Virginia laws designed to prevent utility service disruptions because of labor disputes apparently were completely successful. In Washington, where national labor legislation has been a primary legislative topic for months, sentiment seemed to be crystallizing in favor of injunctive legislation protecting the public interest in utility labor disputes.

In the nation's capital, the Senate Labor Committee,—which a week before had been reported cool to the Hartley Bill giving emergency injunctive powers to the President for use against strikes affecting the public safety,—agreed "informally" upon legislation which would do just that, basically.

Specifically, developments resulting from the first days of the telephone strike were as follows:

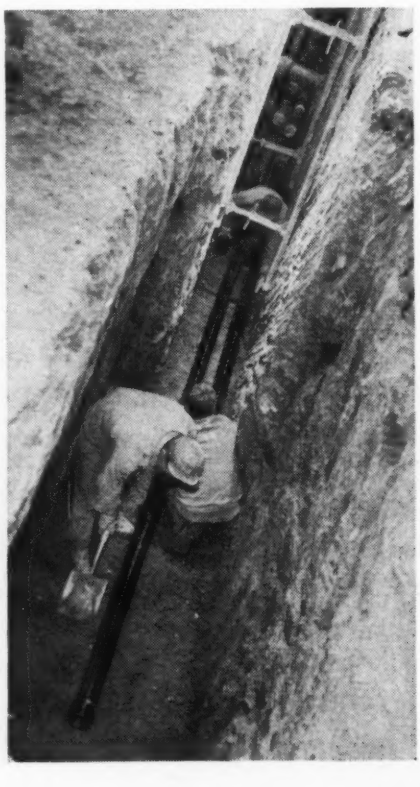
Indiana—Interstate service was normal, apparently solely because of the recently-enacted bill which requires arbitration of labor disputes threatening utility service disruptions. James Orr, vice-president of the Indiana Telephone Workers Union, said the three unions of the Indiana Bell system had "orders not to walk out," according to the Indianapolis News. The order reportedly came from the National Federation of Telephone Workers, which called the strike. Orr indicated the belief that the order was based on the new utility-strike law.

W. A. Hughes, president of Indiana Bell, also expressed belief that the law had averted the strike.

Virginia—Formal steps under Virginia's new anti-service-disruption law were taken early in the telephone strike, but intrastate service remained unhampered by the nationwide walkout. Union officials delivered the second report of a stalemate in negotiations to Governor Tuck, as required by law. Such notification permits the governor to request arbitration. If such action be rejected, the union may then file a notice of intent to strike after five weeks waiting period. Thus, with observance of the Virginia law preventing immediate walkouts, the state seemed safe from any breakdown of local phone service.

The Virginia telephone union, according to the Richmond Times-Dispatch, has taken the position that it will adhere strictly to the new Virginia statute, which was enacted a year after Governor Tuck drafted employees of the Virginia Electric & Power Co. into the state militia to prevent a threatened walkout last year.

New Jersey—When the "Edge Act," authorizing state seizure, but containing no penalties, failed, Governor Driscoll immediately pressed for penalties which would give the law effect. Passed in a night session, the bill was ready for signing on the third day, but approval was withheld until late Wednesday to give workers and management an opportunity to comply. Patterned somewhat after the Indiana anti-utility-strike law, the New Jersey legislation makes each day's violation of the act a separate offense. It would become effective immediately upon signing. Under it, seizure is deferred during the 60-day cooling-off period to permit additional attempts at settlement. Upon expiration, seizure is ordered, and arbitration by a five-man board takes place. Labor and management select one member apiece, with the remainder chosen by the first two. The board must report within 30 days, and its findings are conclusive and binding.



UNDERGROUND IN ASHTABULA—Underground lines crew of Cleveland Electric Illuminating Co. lays fiber duct which will carry 13,200-volt cables in first underground system in Ashtabula, Ohio. The line will be 5 miles long

ELECTRICAL WORLD ★ ★

Washington—At mid-week, Congressional sentiment — not necessarily stable—stopped short of endorsing compulsory arbitrations or seizure as preventives for utility service disruption. It did favor giving the federal government powers pending mediation or fact-finding. The right to strike, and that of voluntary settlement, would remain, under present thinking. In neither the House nor the Senate was there any tendency to rush through emergency legislation aimed primarily at the telephone strike.

•

Reduction in Coal Output Not Yet Felt by Industry

The partial work stoppage in the soft coal mines was only beginning to make itself felt in the electrical industry during the first three days of this week.

Electric utilities, with total stocks on hand sufficient for about two months' operations, generally were prepared to ride out a brief interruption of fuel deliveries. As usual, however, some of the smaller plants were operating with a few days' supply and soon would need assistance. No relief was in sight for such hardship cases since most of the coal brought to mine heads before the miners' stopped work already had been moved, according to the Office of Defense Transportation.

Electrical equipment manufacturers expected to feel the pinch of reduced steel supplies in the near future. The steel industry, which had coal stocks estimated at about a month's supply, already were planning production curtailment against the possibility of an extended coal strike.

•

Utilities Merger Approved

The merger of the electric facilities of the Torrington Electric Light Co. with those of the Connecticut Power Co., New London, has been approved by the Federal Power Commission.

E. E. I. Conference Speakers Warn Selling Time Is Here

Planned Lighting Program Announced at Chicago Meeting of 800 Sales Executives—Indianapolis Heat Pump Market Active — Television and Frozen Foods Will Boost Sales

"If you are to preserve free enterprise in utility operation, neither you nor your managements can ever afford to become complacent and satisfied with your sales results," declared Don G. Mitchell, president, Sylvania Electric products, to some 800 utility sales executives at the annual sales conference of Edison Electric Institute in Chicago last week.

That the time for selling has come was the theme pervading the meeting. There is little now to be sold, neither appliances nor kilowatt-hours. But selling had better start because it should not take long for electrical goods production to get rolling in heavy volume. And the capacity shortage won't last forever. Also, as stated by Ralph P. Wagner, chairman of the conference, "We are now on the verge of a buyers' market where selling will again be a must for every sale."

Outstanding indication at the meeting that the industry is getting up selling steam was the formal announcement of the Planned Lighting Program which was previewed in Electrical World last week. The homes, schools, offices, stores and factories of the nation need three to seven or more times as much lighting as they now have, said Harry Restofski, chairman of the Better Light-Better Sight Bureau. Then, in effect, J. S. Schuchert, chairman E.E.I. Commercial Section, replied, let's give it to them, sell it to them, through the Planned Lighting Program.

PL means PL—Planned Lighting means Profit Load—was the big push of the meeting, but not by any means to the neglect of other potentialities. Residential, farm, commercial and industrial load developments were covered in detail in a full day of parallel meetings of the four sales sections concerned as well as in papers presented in the two days of

EXCHANGING INFORMATION—Wilson Arthur, Consumers Power Co.; Rodney Doerr, Pacific Gas & Electric Co.; D. M. DeBard, Stone & Webster Service Corp.

UTILITY MEN—A. D. McLay, left, Detroit Edison Co., and H. P. J. Steinmetz, Public Service Electric & Gas

NEMA REPRESENTATIVE—Reese Mills, Westinghouse, and W. J. Donald, managing director of NEMA

the general sessions of the conference.

A quarter of the new homes costing $9,000 or more, built in his city in the next five years are expected to be equipped with heat pumps, prophesied A. C. Crandall, Indianapolis Power & Light Co. In addition, he said, ten percent of existing homes in the city will buy heat pumps in the same period. All this assuming that the equipment will be available. And this will mean an annual increase of over 31 million kw.-hr. in residential sales of the power company, 17.4 percent of 1946 sales.

Then television will boost residential sales some more, according to R. R. Kraft, National Broadcasting Co. The average television set will take 300 watts. In 1947, 400,000 of them will be sold, and rapidly increasing numbers will go into users' hands in succeeding years. Assuming one, two, three, or more hours of use per day, almost any increase in residential kw.-hr. sales can be figured.

The frozen food industry can be expected to use 11 billion kw.-hr. per year eventually, said E. W. Williams, publisher of the magazine "Quick Frozen Foods." That energy consumption will be required by the anticipated 40 billion-pound production of such foods by 1955. And that estimate does not include energy used by home freezers.

Research to determine new and profitable uses of electricity for various farm tasks is needed, according to Paul E. Miller, University of Minnesota. He pointed out that with a drop in prices of farm products apparently not far ahead electrical applications that will reduce costs become increasingly urgent.

Appliance inventories should be held to minimum requirements, said Paul L. Morrison, Northwestern University, and although there will be some readjustments, appliance prices will settle at a level considerably above the pre-war range. It's going to be a case of "sell or go bust," some soft goods lines are already headed into that condition, said Arthur H. Motley, "Parade" Publication, Inc.

Competition is the life of trade; instead of worrying about competition with each other, let's both work hard to make certain that we can remain in competition. That was the advice of Howard D. White, Liquified Petroleum Gas Association. In 1946, nearly 1½ billion gals. of liquified gas were sold to 3½ million consumers. Actually, implied Mr. White, that is not really heavy competition.

"Tool Up for Sales Training," a presentation of the need for effective methods, devices and props which used exactly those tools to put its story over, was staged and played by a group of Public Service Electric & Gas (Newark, N. J.) men, E. T. Brewer, F. C. Pesveye, R. O. Doerr, W. B. Statham, and C. A. Stevens.

Announcement was made that the winner of the Thomas W. Martin award for 1946 for "outstanding performance in promotion of rural electrification," was Ralph J. Bugbee, Central Vermont Public Service Corp.

MANUFACTURERS—T. J. Newcomb, left, Westinghouse Electric Corp., and B. E. Sullivan, General Electric Co.

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December Electric Energy Sales Rise 14.2 Percent

Sales of electric energy to ultimate customers in December, 1946, totaled 17,450,280,000 kw.-hr., compared with 15,283,489,000 kw.-hr. in December, 1945, an increase of 14.2 percent, Edison Electric Institute has reported.

Revenue from ultimate customers amounted to $310,910,400 in December, compared with $284,844,600 in December, 1945, an increase of 9.2 percent.

For the twelve months ended December 31, 1946, the average use per customer advanced to 1,329 kw.-hr. from 1,229 kw.-hr. for the preceding year, an increase of 8.1 percent; the average annual bill to $42.79 from $41.91, an increase of 2.1 percent; revenue per kw.-hr. dropped to 3.22 cents from 3.41 cents, a decrease of 5.6 percent.

Classification of Sales, December, 1946 and Change from 1945

Kilowatt-Hour Sales December	1946	1945	% Change
Residential or domestic	3,739	3,275	+14.2
Rural (distinct rural rates)	302	264	+14.6
Commercial or Industrial			
Small light & power	3,018	2,663	+13.3
Large light & power	8,832	7,561	+16.8
Street & highway lighting	236	223	+ 6.0
Other public authorities	600	540	+11.2
Railways & railroads			
Street & interurban	428	460	— 7.0
Electrified railroads	239	242	— 1.1
Interdepartmental	55	56	— 0.9
Total to ult. customers	17,450	15,283	+14.2

Chemicals Use Power

The greatest user of electric energy in 1946 was the chemical industry, the Federal Power Commission has reported. The chemical industry used 21,565,205,000 kw.-hr., iron and steel 19,405,503,000, mining, smelting, and refining 16,303,935,000, and paper 12,153,575,000.

The highest percentage consumer of electric energy by motors was the metal mining industry which used 96.59 percent of its total power consumption in this way. Non-metallic mining used 94.99 percent, paper 93.10, coal mining 92.11, petroleum and natural gas 90.12, textile 89.43, and food 87.26.

Industry Told to Act to Prove Value of Free Enterprise

Dangers of Government Competition Stressed by Speakers at Annual Meeting of Southeastern Electric Exchange—Lee Hill Recommends Methods of Improving Employee Relations

PRESIDENTS—L. V. Sutton, left, Carolina Power & Light Co., and Thomas W. Martin, Alabama Power

A CHALLENGE to industry to actively enter the fight to preserve the American free enterprise system and to combat any movement to socialize the nation's economy was issued last week at the annual conference of the Southeastern Electric Exchange at St. Petersburg, Fla.

The more than 400 utility executives present were told by business leaders that it will be by direct action rather than by words that industry can demonstrate that free enterprise is the foundation of democracy and the basis of future prosperity and economic security. This same note of positive action was issued by Clifton A. Woodrum, president of the American Plant Flood Council and for 23 years a Virginia Congressman.

Unsuspecting Taxpayer Pays

He warned of the dangers of government competition and made pointed reference to the "working over" of the utility industry by Uncle Sam. He declared that as a competitor with private enterprise, the government had a decided advantage as the cost of subsidizing its projects is passed on to the unsuspecting taxpayer.

Association president W. E. Wood, executive vice-president of Virginia Electric & Power Co., cautioned the utilities not to permit themselves to imagine that the "welcomed swing towards free enterprise", as indicated in the recent national election, has removed the ominous threat which has been hanging over the industry.

He warned the utility delegates that the industry may face a real shortage of power capacity in the next three or four years. As a means of averting this he suggested that the companies in the Southeast devise a method of pooling resources and by mutual cooperation utilize all available capacity to the greatest possible extent.

The Exchange has completed arrangements for another year of research toward development of the heat pump by the Southern Research Institute. Dr. Kemler will direct the work under the steering committee headed by Wells M. Stanley, vice-president of Alabama Power Co.

Frank M. Wilkes, president of Southwestern Gas & Electric Co., and Kinsey M. Robinson, president of Washington Water Power Co., revealed the conditions which exist when federal bureaus move in to compete with private enterprise.

In his prepared speech, read by J. Robert Welsh, operating superintendent, Wilkes warned that the electric utility industry is facing an immediate crisis in that either the new Congress is going to turn sharply to the right, with an understanding of utility problems and needs, or continue to the left, and public utilities, under business-managed operations, will cease.

Robinson said that free enterprise still survives in the Northwest in the face of steady encroachment by the government. He stated that prior to government development, the private and municipal systems were tied together in a power pool, and that later the federal plants were connected to give the region a great power pool.

As for the continuation of private operations in the Northwest, much depends, upon the extent of federal pressure, Robinson declared, as he asked support of the industry in the fight against further encroachment by the government on private enterprise.

Lee H. Hill, editor and publisher of ELECTRICAL WORLD, suggested methods to improve employee relations, the first step in good labor relations.

A former industry member of the War Labor Board and an authority on labor relations, Hill was not optimistic about any constructive labor legislation coming out of Washington this year. He said that management can accomplish more through its own efforts than by looking to Congress.

Most labor relations problems can be eliminated through good employee

St. Petersburg Times

BACKGROUND FOR THE EDITOR—Lee H. Hill, editor of Electrical World, gets a confidential report on the industry in South Carolina from E. L. Godshalk, left, president of the South Carolina Power Co., and on conditions in the Northwest from K. M. Robinson, president of the Washington Water Power Co., center.

HOST AND GUESTS—Pat Flanagan, director of advertising for the Florida Power Corp., St. Petersburg, and "official host" to the Southeastern Electric Exchange delegates, poses with T. A. Busby, left, vice-president of the South Carolina Power Co.; and J. A. Whatley, center, Ohio Brass Co.

relations, Hill declared. and suggested reasons why this important phase of management has been neglected. He also offered recommendations to bring about better employee relations.

These included sound hiring procedures; proper placement and provisions for advancement; job analysis, job evaluation and setting of wages in relation to skill and responsibility; job training, including supervisors; someone to checkup to insure company policies are known and carried out to insure cooperation and fairness to all employees; a developed program so that all employees are bearers of good public relations; and exit interviews to find out why workers terminate employment, a valuable source of information on employee attitudes.

A down to earth talk on mechanics of public and employee relations was presented by C. J. Allen, vice-president of Connecticut Light & Power Co., and president of the Public Utilities Advertising Association. His remarks detailed the soundness of top management working closely with the public relations and advertising director. He cautioned against management retreating into a shell of "no comments," or "nothing to say" policy which gives the other side the advantage of the opportunity of presenting its case. "For executives to retire into secretive silence," he declared, "is the height of folly for the company and its chiefs."

McGregor Smith, president of Florida Power & Light Co., was elected president; M. C. Funk, vice-president and general manager of Appalachian Electric Power Co., W. M. Rogers, president of Birmingham Electric Co., and S. C. McMeekin, president of South Carolina Electric & Gas Co., were elected vice-presidents.

FLORIDANS—George Grimm, vice-president, and Jerry Watson, right, purchasing agent, Florida Power

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Certified Lamps to Reach Trade before Big Shows

Private and individual showings for the trade of the new Certified Lamps, in advance of the Chicago and New York shows, will start June 9, Don M. Julien, executive secretary of the Certified Lamp Makers, recently announced.

Certified Lamp makers will be delivering lamps in quantity to retailers so that consumer selling will start early in the fall. Introduction of the lamps will be accompanied by a widespread promotion campaign throughout the entire trade and consumer field.

War-Time Industry Feats Commended at Conference

Admiral Halsey Advises Midwest Group Healthy National Economy Necessary for Nation's Defense

Commendations for the adequate war-time supply of power and concern over the present capacity reserve and general economic trends were highlights of the Midwest Power Conference in Chicago last week.

Fleet Admiral William F. Halsey, U. S. N., urged the engineers to be cautious in assuming that research alone can provide adequate national defense. Our security must rest upon a progressive military establishment backed by a healthy and vigorous national economy, he emphasized. Although paths of development are indicated, push-button war is far away.

Also speaking at the "All Engineers Dinner" Richard R. Deupree, Procter & Gamble Co. and chairman of the Army and Navy Munitions Board, proposed that about 100 plants operated by the government during the war should continue to be government owned. He outlined the objectives of industrial mobilization plans which he said must be put into operation in months rather than years in case of another emergency situation.

Power Demand Growing

In the opening meeting of the conference, H. S. Bennion, Managing director, Edison Electric Institute, reviewed factors in the record demand for electric power which has narrowed the margin between load and capacity from 40 percent in 1939 to less than 10 percent in 1946. Deliveries of new generating equipment this year are expected to about equal further increase in demand, added to the peaks of last year, so a reserve margin is still some distance in the future.

W. C. Johnson, Allis-Chalmers Manufacturing Co., explained some of the delay in deliveries with an analysis of the strike situation during the past year. During the past year, strikes have cost the country the entire productive life equivalent of 9,675 men, he estimated, and concluded that such continued loss of production is the greatest threat to our economic security.

E. W. Oesterreich, Duquesne Light Co., reported its experience in reconstruction of transmission lines to meet desired values of lightning protection. He concluded that the performance data should create further confidence in the accuracy of data and methods now available for line design.

George H. Landis, Central Hudson

Gas & Electric Corp., believes that aerial cable construction need no longer be considered experimental and that its use will increase rapidly. Extended use should decrease cable cost with larger volume manufacture, and help in development of cable fittings. Cost of cable construction is comparable to open wire construction where heavy tree trimming is involved, and operating performance is far superior.

Carrier relaying systems will replace present slower relays on many lower voltage lines for which they have not previously been considered economical, in the opinion of R. C. Cheek, Westinghouse Electric Corp. Carrier channels will also be used much more widely in the telemetering, load control and supervisory control fields in addition to the present uses in communication.

W. D. Cockrell, General Electric Co., said that development of industrial electronic control is separating from radio practice toward more sturdy construction. Many new applications are being made, and the field of electronics is being rapidly extended.

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FPC Will Probe Rates Of Union Electric Power

Rates charged by the Union Electric Power Co., Monsanto, Ill., for energy sold at wholesale in interstate transactions are being investigated by the Federal Power Commission.

The company is a subsidiary of the Union Electric Co. of Missouri, which is its principal customer for wholesale energy. Union Electric Power transmits and sells energy at wholesale in Illinois, Iowa, and Missouri, and sells at retail in several Illinois communities.

Congressional Efforts to Cut Interior Power Business Fail

Western Republicans Oppose Slashes in Budget—Rockwell Introduces 2 New Bills to Replace Former One Which Had Brought Strong Opposition from Officials Including Krug

ONE OF two Congressional efforts to curtail major power operations of the Interior Department apparently had collapsed this week, and the other was in danger of a similar fate.

Western Republicans have put the brakes on both drives which had been developing in House committee sessions. The Westerners were openly hostile toward reported slashes of the Interior budget for fiscal 1948 by the Appropriations Committee, and, at the same time, they stalled action on the Rockwell Bill (ELECTRICAL WORLD, February 22, Page 3), their own proposal for making irrigation, rather than hydroelectric power development, the principal objective of the Federal Reclamation Program.

Committee action on Interior's 1948 appropriations already has been completed, but the bill still has not been sent to the House floor. However, rumors that all Interior budgetary allotments would be heavily cut, particularly those of the Reclamation Bureau and Bonneville Power Administration, have buzzed about the capitol for weeks. Western Republicans in the House have more or less openly threatened to join with the Democrats to restore funds for Interior's river development program eliminated by the Appropriations Committee.

At the same time, the Western bloc, through its control of the Public Lands Committee, redrafted the Rockwell Bill, then postponed further hearings until April 17. Originally the bill proposed by Rep. Robert Rockwell, Colorado Republican, called for transfer from the Secretary of Interior to the Congress of the former's power to authorize Reclamation projects and for sweeping reforms in the methods of amortizing the federal government's investment in such work.

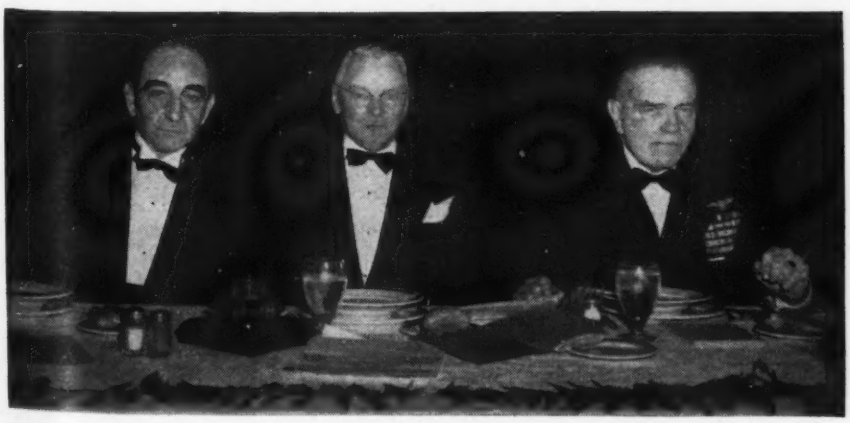
Two new bills have been presented by Rep. Rockwell to replace this measure. One would merely set aside an interpretation of the Reclamation Project Act of 1939 by former Interior Solicitor Fowler Harper. It would require that power revenues from multiple-purpose Reclamation projects be sufficient to repay (1) the government's investment in power installations, (2) interest at 2 percent thereon, and (3) a portion of the irrigation costs. It would forbid the application of the interest on power, as approved by the solicitor's opinion, to repayment of the irrigation investment.

Republican Asked Similar Law

The second would contain the same language, plus a provision requiring repayment to the Treasury of appropriations from its general funds for Reclamation work. Legislation of the latter type had been requested by Rep. Robert Jones, Ohio Republican and chairman of the subcommittee on Interior appropriations. Since passage of the 1939 act all repayments from Reclamation projects have gone into the Reclamation fund which can be drawn upon only through appropriations for new Reclamation development.

Sponsors of the new and old Rockwell Bills asserted that their change of tactics was brought about by the broad opposition to the original measure. They were still in favor of its many reforms, they said, but it seemed "practical" to seek only the most important features of the bill at the present time, temporarily dropping the other points involved.

Interior officials, including Secretary Krug, vigorously opposed the Rockwell Bill during the extended hearings already held by a Public Lands sub-



SPEAKERS—At the speakers table at the "All Engineers" dinner held during the Midwest Power Conference, left to right, Richard R. Deupree, James D. Cunningham, who was toastmaster, and Fleet Admiral William F. Halsey

committee. They contended that the measure would increase the rates for Grand Coulee power 75 percent and force comparable increases in charges for hydroelectric energy from all multi-purpose Reclamation projects.

These spokesmen also pointed up the fact that the demand for revision of Reclamation laws had stemmed, in part, at least, from Eastern Congressmen controlling the House Appropriations Committee. They indicated that they will continue to fight any effort to upset the solicitor's opinion but that they have no serious objection to repayment of appropriations from the Treasury's general funds.

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'46 Canadian Output Sets Record; Primary Use Low

Canadian central electric stations set a record high production mark of 41,603,708,000 kw.-hr. in 1946, but consumption of primary power was only 31,063,240,000 kw.-hr., approximately 13 percent below the record consumption of 35,718,765,000 kw.-hr. in 1943. The previous output record was set in 1944 with 40,465,733,000 kw.-hr. A report released by the Dominion Bureau of Statistics shows that consumption of primary power in December was 2,877,011,000 kw.-hr., the highest since October, 1944, when consumption was 2,942,384,000 kw.-hr.

Total production of power in December also set a new record of 3,672,116,000 kw.-hr. The previous high was in May, 1946, when 3,615,777,000 kw.-hr. were produced.

The following statistics are in thousands of kilowatt hours:

Period	1946	1945
Twelve months	41,603,708	30,100,608
Primary	32,461,904	32,234,644
Secondary	9,141,804	7,865,964
Exports to U. S.	2,472,979	2,631,245
December	3,672,116	3,288,710
Primary	2,997,925	2,610,232
Secondary	674,191	678,478
Exports to U. S.	166,716	217,737
November*	3,566,742	3,236,986
Primary	2,888,900	2,552,585
Secondary	677,842	684,401
Exports to U. S.	140,005	218,587

* Revised

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Union Wins Pay Raise

Appalachian Electric Power Co. and the International Brotherhood of Electrical Workers, A.F.L., have reached an agreement under which all union members will receive an 11-cent hourly increase. Employees with 20 years of service will also receive three weeks vacation. The utility has also extended the raise to non-union employees.

SEC RULINGS

The Securities and Exchange Commission recently issued a series of orders affecting electric utility companies.

AMERICAN LIGHT & TRACTION CO. has been granted permission to acquire 128,920 shares of Detroit Edison Co. stock under terms of a 10 percent stock dividend to be paid by Detroit. American now owns approximately 20.3 percent of Detroit's common capital stock. (Release No. 7293).

SOUTHERN INDIANA GAS & ELECTRIC CO. has received permission to amend its charter so as to provide that whenever and as often as four quarterly dividends payable on its preferred stocks of any series shall be in default in whole or in part, the holders of its preferred stock shall have the exclusive right, voting separately and as a class, to vote for and elect the smallest number of directors which shall constitute a majority of the then authorized number of directors of the company, and in all elections of directors, each stockholder entitled to vote shall have cumulative voting rights. Commonwealth & Southern Corp. (Del.) joined its subsidiary in the petition. (Release No. 7300).

MILWAUKEE ELECTRIC RAILWAY TRANSPORT CO., a subsidiary of Wisconsin Electric Power Co., has been granted permission to redeem on April 16, at par plus accrued interest, $1,050,000 of $5,050,000 of 4 percent bonds, due 1968, outstanding. All of the bonds are owned by the parent company. (Release No. 7302).

WISCONSIN HYDRO ELECTRIC CO. has been granted an exemption from competitive bidding with respect to a proposal to sell $1,750,000 of 3⅛ percent first mortgage bonds due 25 years from date to Massachusetts Mutual Life Insurance Co., Equitable Life Insurance Co. of Iowa, and Modern Woodmen of America; and to sell $250,000 of 3 percent serial notes, due $25,000 semi-annually, to Harris Trust & Savings Bank, Chicago. The proceeds of bonds and notes will be used in payment of the 5 percent first mortgage bonds outstanding in the principal amount of $2,077,000, which mature October 1, 1947. (Release No. 7305).

GENERAL PUBLIC UTILITIES CORP. has been given approval to issue and sell to four commercial banking institutions unsecured promissory notes in amount not to exceed $9,600,000. The money secured is to be used as follows: up to $4,300,000 to acquire not more than 479,235 new common shares of New England Gas & Electric Association under an alternate plan of recapitalization of New England, $2,000,000 to repay a bank loan, and $3,300,000 to reimburse General Public for net capital contributions of $10,500,000 made by it to its subsidiaries since June 1, 1946. (Release No. 7306).

POTOMAC ELECTRIC POWER CO. has received permission to borrow during a two-year period, $12,000,000 from 20 commercial banks. (Release No. 7311).

NEW ENGLAND GAS & ELECTRIC ASSOCIATION has been authorized to sell $841,000 of United States ⅛ of 1 percent United States certificates of indebtedness at market prices with accrued interest to New Bedford Gas & Edison Light Co., a subsidiary. New England will use proceeds in carrying out an alternate plan of recapitalization already approved by SEC. (Release No. 7315).

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New Franchise Voted

Iowa Public Service Co. has been voted a new 25-year franchise in Sheldon, Iowa.

MEETINGS

Pennsylvania Electric Association—Communications Committee, Roosevelt Hotel, Pittsburgh, May 1-2. W. C. Feaster, chairman, Potomac Edison Co., Hagerstown, Md.

Southeastern Electric Exchange—Power Sales Conference, Thomas Jefferson Hotel, Birmingham, Ala., May 8-9. J. W. Talley, executive secretary, 303 Haas-Howell Building, Atlantic 3, Ga.

Edison Electric Institute—Annual Meeting, Hotel Traymore, Atlantic City, June 2-5. H. S. Bennion, managing director, 420 Lexington Ave., New York 17, N. Y.

Pacific Coast Electrical Association—Annual Meeting, Mission Inn, Riverside, Calif., June 4-6. J. A. Long, chairman, Southern California Edison Co., Los Angeles, Calif.

Previously Listed

Pennsylvania Electric Association—Systems Operation Committee, Hotel Statler, Buffalo, N. Y., April 24-25, Transmission & Distribution Committee, Irem Temple Country Club, Dallas, Pa., May 22-23.

Indiana Electric Association—Annual Young Men's Utility Conference, IPALCO Hall, Indianapolis, April 15-16.

Missouri Valley Electric Association—Engineering Conference Hotel Continental, Kansas City, Mo., April 16-18: Rural Roundtable, Hotel Continental Kansas City, Mo., April 22; Sales and Rural Conference, Hotel Continental, Kansas City, Mo., April 23-24.

National Rural Electric Cooperative Association—Annual Meeting, Davenport Hotel, Spokane, Wash., April 22-25.

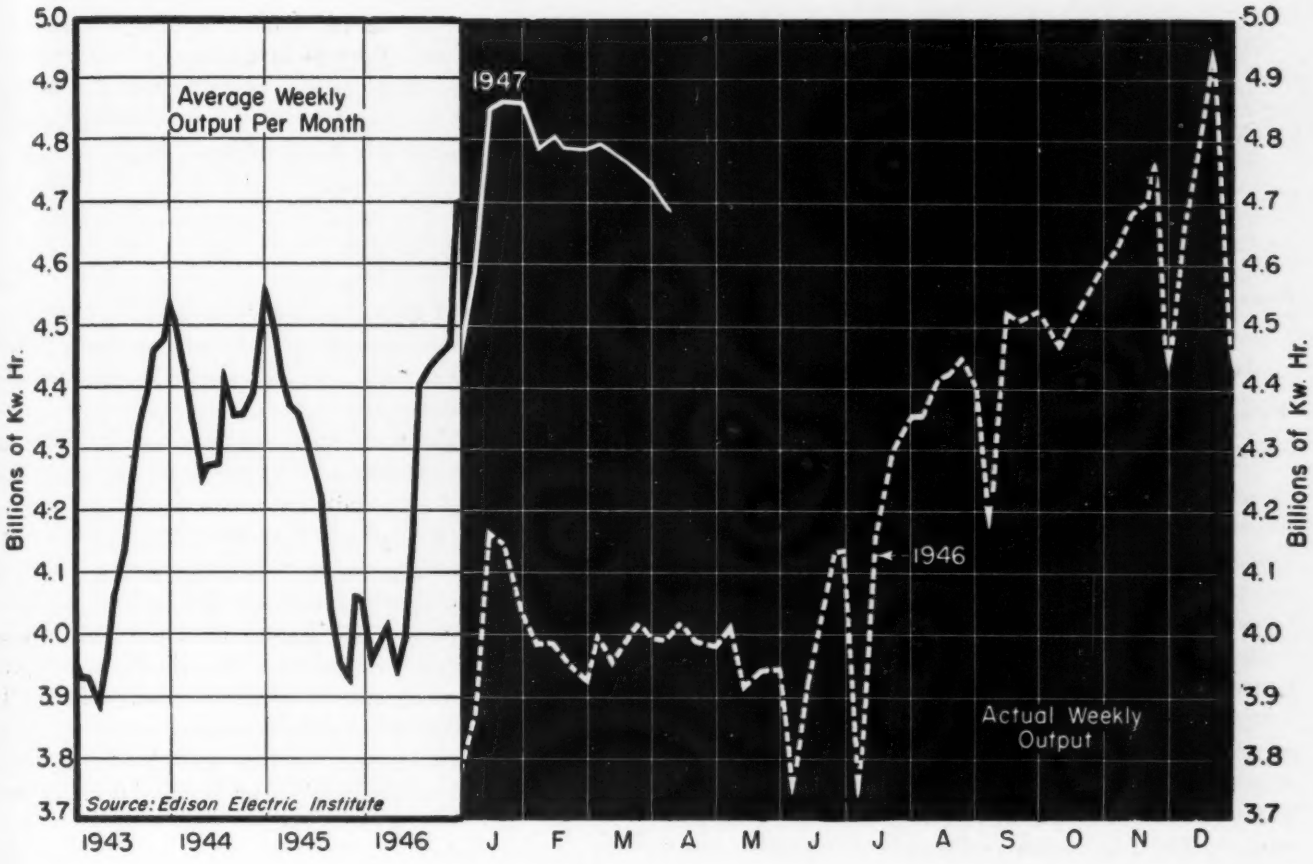
Edison Electric Institute—Engineering and Accident Prevention Committee, Edgewater Beach Hotel, Chicago, April 28-30.

National Electrical Wholesalers Association—Annual Convention, Hotel Traymore, Atlantic City, May 4-8.

Northwest Electric Light & Power Association—Business Development Section, Olympic Hotel, Seattle, Wash., May 7-9.

Southeastern Electric Exchange—Home Service Conference, Thomas Jefferson Hotel, Birmingham, Ala., May 13-14.

American Public Power Association—Annual Convention, Hollenden Hotel, Cleveland, May 21-23.



Gas Turbine Research Is Underway in 3 Countries

In at least three countries, research on gas turbines is well under way. Though the problems to be solved are many and few companies are willing to reveal the progress they have made, it is known that 14 companies in the United States, 10 in Great Britain, and four in Switzerland are now carrying on such research.

Some of the companies are interested in the smaller type turbine that can be used in planes; the others are experimenting with units in the 5,000-hp. class that could be used for locomotives and for power plant installations.

The American companies doing gas turbine research are Allis-Chalmers Manufacturing Co., Boeing Aircraft Corp., Chrysler Corp., De Laval Steam Turbine Co., Elliott Co., General Electric Co., General Machinery Corp. (Hooven-Owens-Rentschler Div.), General Motors Corp. (Allison Engine Div.), Menasco Manufacturing Co., Northrup-Hendy Co., Packard Motor Car Co., United Aircraft Corp. (Pratt & Whitney Div.); Westinghouse Electric Corp., and Wright Aeronautical Corp.

British companies are Armstrong-Siddeley Motors, Ltd., A. V. Roe, Ltd., Bristol Aeroplane Co., British Thomp-son-Houston Co., C. B. Parsons & Co., DeHavilland Engine Co., English Electric Co., Metropolitan-Vickers Electric Co., Power Jets, Ltd., and Rolls-Royce, Ltd.

Swiss companies are Brown-Boveri & Co., Escher-Wyss Engineering Works, Oerlikon Machine Works, and Sulzer Brothers, Ltd.

California Home Service Director McCall Winner

The five winners of the 1946 Laura McCall awards for outstanding contributions made by home service departments of electric light and power companies in promoting a more efficient use of electricity and electrical equipment in the home have been announced.

First prize went to Miss Marguerite Fenner, director of home economics, Pacific Gas & Electric Co., San Francisco. In order, the other winners were Miss Emma L. Renaud, New York Power & Light Corp., Albany; Miss Vivian Marshall, New Orleans Public Service Inc.; Miss Charlotte Mobley, Duke Power Co., Charlotte, N. C.; and Miss Kathryn M. Holy, Florida Power Corp., St. Petersburg.

The competition is sponsored by "McCall's Magazine" and is administered by the Edison Electric Institute.

Holiday Decline Slight

Showing but little the effects of the Easter holidays, the output of the light and power industry dropped to 4,693,055,000 kw.-hr. for the week ended April 5, 1947. This was still 17.7 percent above the corresponding week of 1946 when the figure was 3,987,673,000 kw.-hr. Edison Electric Institute figures for the preceding week in 1947 were 4,728,885,000 kw.-hr.

In output gain over the corresponding week of last year, the Pacific States led with a 24.7-percent increase, followed by the Central Industrial group, with a 21.1 percent gain.

Weekly Output, Millions Kw.-Hr.

1947		1946		1945	
Apr. 5	4,693	Apr. 6	3,938	Apr. 7	4,322
Mar. 29	4,729	Mar. 30	3,992	Mar. 31	4,329
Mar. 22	4,759	Mar. 23	4,017	Mar. 24	4,402
Mar. 15	4,764	Mar. 16	3,988	Mar. 17	4,398
Mar. 8	4,787	Mar. 9	3,953	Mar. 10	4,446
Mar. 1	4,797	Mar. 2	4,000	Mar. 3	4,472
Feb. 22	4,778	Feb. 23	3,923	Feb. 24	4,474
Feb. 15	4,778	Feb. 16	3,949	Feb. 17	4,472
Feb. 8	4,801	Feb. 9	3,983	Feb. 10	4,505
Feb. 1	4,777	Feb. 2	3,983	Feb. 3	4,539
Jan. 25	4,856	Jan. 26	4,034	Jan. 27	4,577
Jan. 18	4,857	Jan. 19	4,145	Jan. 20	4,588

Percent Change from Previous Year

	Apr. 5	Mar. 29	Mar. 22
New England	+8.9	+13.1	+11.5
Mid-Atlantic	+10.8	+13.6	+11.8
Central Industrial	+21.1	+24.4	+23.9
West Central	+18.2	+16.3	+16.3
Southern States	+18.0	+17.0	+21.4
Rocky Mountain	+12.2	+13.6	+9.1
Pacific Coast	+24.7	+19.6	+19.9
Total United States	+17.7	+18.5	+18.5

Electrical World OPINION

Priorities in Mobile Communication

PROSPECTIVE USERS of mobile-radio got a go-ahead on March 21, 1947, by a Federal Communications Commission order which substantially completes the reallocation of all mobile-radio service frequencies above 30 megacycles, and assigns 31 specific channels for the use of "power utilities".

It was evident in the FCC hearings leading up to this frequency reallocation that the demand for channels from many sources greatly exceeds the number available. Consequently, no service can expect to retain unoccupied channels. Utilities contemplating the installation of a radio system should proceed promptly, or they may find power utility frequencies reallocated to a service which will use them.

The telephone companies, recognizing this situation, have vigorously carried the development of their "common-carrier service" to a point where all available frequencies are utilized in some areas. They have requested FCC to provide additional channels for this service. Under this service, up to 70-odd vehicles of all kinds share each channel on a party-line basis. The system provides no control of talk-back priority, and thus fails to insure its immediate availability in emergencies, which is the prime requirement for power utilities. To circumvent this objection, the telephone companies are offering a second type of service consisting of a completely independent system which they will install and maintain but which would be leased, licensed and operated by the power company on a power utility frequency. Several utility companies who do not wish to be burdened with technical communication problems have contracted for such systems which, from an operating standpoint, are equivalent to one owned and maintained by the utility company.

Prospective users should also investigate the possibility of using the two high frequency bands which the commission has allocated to the mobile services. Most of the 250-odd utility licensees operate in the 30-40 mc. band, where congestion and interference are frequently troublesome. Recent experience (see ELECTRICAL WORLD, February 1, 1947) indicates that the 72-76 mc. band, which is neither congested nor as susceptible to skip interference as the lower band, can be used successfully even in hilly country. Other tests have demonstrated that the 152-162 mc. band also offers unique advantages which should not be overlooked.

Thus there are three ways in which prospective utility users may avoid the uncertainties of a service which offers inadequate priorities in times of emergency.

Who's Indicted?

A WEEK or more after it made available to the press one copy of its voluminous report on copper, the Federal Trade Commission made available generally a short summary of the entire report.

Available to the press—and published in ELECTRICAL WORLD—was an assertion that, just one year ago, the copper industry in the United States faced a bigger stockpile, about 700,000 tons, than it had when, after the first World War, it participated in certain international activities aimed at controlling markets and prices in such fashion as to cushion the impact of the excess metal. Following this was the assertion that the U. S. copper industry, in the early months of 1946, "might consider it to their advantage to permit the continuance of labor difficulties to curtail copper production, at least until such time as the large stockpile might be drawn down." (page 369, vol. I.)

Under the existing political situation, this is about as serious an allegation as the entire report might contain. It would be logical to expect any such summary as FTC later released to contain at least a reference to this charge. But the summary contained no such information. Instead, it contained such imposing items as the following:

"In March, 1937, Kennecott Copper Corp purchased from Ohio Copper Co. of Utah, 120 acres of patented lode claims and mines in Bingham Canyon, at Lark, Utah. The purpose, however, was not that of obtaining these mines with their nearly-exhausted low-grade ore bodies, but to obtain this space through which to construct part of a vehicular tunnel between two towns in the canyon, so that Utah Copper Co. could close the main highway between those two towns and extend its open-pit mining in that canyon." (page 27, summary, vol. II)

So it goes. FTC permits the press to read and publish its ex parte "indictments," but is unable to make copies available to its "defendants." When it can muster a summary of its "indictment", it by-passes a main issue, and dwells on such trivia.

FTC's handling of this one indicts itself.

Preferable To Seizure

INDIANA has joined those states which have enacted specific legislation to protect the public from the hardships which are inescapable when there is any pronounced disruption of utility services.

Indiana's law, however, while based on the same public-protection concept which motivated New Jersey and Vir-

ginia legislatures, employs a vastly different means of achieving this end. New Jersey and Virginia employed seizure as the last-resort tool for maintaining continuity of service. Indiana employed conciliation and arbitration, by a specially designated corps of experts. It surrounded them with certain safeguards, aimed at protecting the interests of the parties to a dispute. For instance, arbitrators may not go beyond the terms of an existing contract. If no contract exists, wages, hours and working conditions are tied as closely as possible to those existing in the same or in adjoining labor markets, and for the same kind of work.

To be sure, any method of handling utility labor disputes will leave something to be desired when compared with the conventional methods applicable to labor disputes which do not involve the public interest and welfare so intimately. The unfortunate fact is that utility labor disputes are inextricably intertwined with the public welfare. Thus, conventional, test-of-economic-strength methods of handling such disputes just may not be permitted to govern.

The choice, in utility labor disputes, is not one of the ideal way to handle a situation, but the most practical and effective way to handle them from the public's point of view.

On this basis, ELECTRICAL WORLD feels that Indiana has chosen the better way, even though its last resort method approaches compulsory arbitration more closely than would be desirable or acceptable in non-utility disputes.

ELECTRICAL WORLD has repeatedly spoken against unlimited arbitration. Here is the first case where principles are pre-established—before the fact—to guide and limit the arbitrator in reaching a decision. As such, the plan involves the same fundamentals as were proposed by ELECTRICAL WORLD, October 26, 1946.

Two Types of Protection

A BRIEF news note from Oslo describes the construction of the "world's first atom-bomb proof factory" at an estimated cost of $14,000,000. Just the thought of such a necessity must appall American manufacturers, including those who manufacture electric power. From a cost viewpoint alone, the prospect is intolerable. Operating-wise, the prospect is even worse.

In the United States, we are attempting to protect everything against atom bombs, not merely one factory. We have decided to do it by human cooperation under law, not by going underground. The logical answer, then, for those needing protection against atom-bombs—and who doesn't—is to make a success of our venture in atom control.

The electric power industry will be one of the first to come directly into contact with the Atomic Energy Commission. It would seem to be the essence of prudent management for the industry to do all it can in helping the commission do an effective job.

WASHINGTON COMMENT

By R. N. LARKIN

THE Senate took, last week, a decisive vote on the nominations to the Atomic Energy Commission. It did so none too early. The law establishing AEC is about eight months old; the phenomenon AEC was established to govern, almost two. If there be any accuracy to repeated assertions that five year's work could develop a feasible nuclear heat source for thermal-electric power generation, then the delay in constituting AEC, and letting it get to work, is doubly unfortunate. Vast as must be the developmental problems of such a nuclear heat source, they are unlikely to exceed the problems which will face AEC in determining the rules under which atomic power plants will be operable.

About a dozen years ago, the Public Utility Act of 1935 was enacted. A decade ago, the Federal Power Commission promulgated its Uniform System of Accounts. Through the years, FPC pushed its "net investment" concept. Right or wrong, the power business differs in form today from what it would have been without these steps.

Today we have a revival of the old story. The characters are new and their medium differs. If nuclear fission fulfills all the promise which some see in it, this revival of the old show could have a much broader effect upon the electric power industry, for there was nothing in the Public Utility Act which directly nationalized the industry.

As should be abundantly plain, the Atomic Energy Act is somewhat tentative. The record indicates Congress' feeling that experience under the law may guide its revision. AEC's entire membership will be subject to appointment and confirmation again in about 16 months. The sober, serious approach with which a majority of Congress has faced that body's dealings with atom control presages sobriety when the subject arises again. Despite the reams of nonsense in the Senate hearings on the AEC nominations, there are many specific passages which testify to Congress' awareness that atomics is now a socialized industry. These testify also to a determination that the bonds of federal monopoly shall be relaxed when and where they may be with safety to the nation.

Thus the power industry has, perhaps, a year and one-half to determine its position on AEC and the law it administers. When Congress considers revising either, it will need the industry's advice on matters comprehended by no other group. That help and advice will be welcome to the extent that it helps Congress solve its—and the nation's—problems. It will be unwelcome to the extent that it fails to be constructive, or seeks unjustifiable, even unsafe, special preference. Having as great an interest in atomics as any industry, the power business can't afford to waste any of the brief period remaining.

Capacitors Start 800-Hp. Motor

Industrial problems call for ingenuity to accomplish results without spending too much money. Capacitors did this job for 10 percent of the cost of hydraulic or magnetic couplings

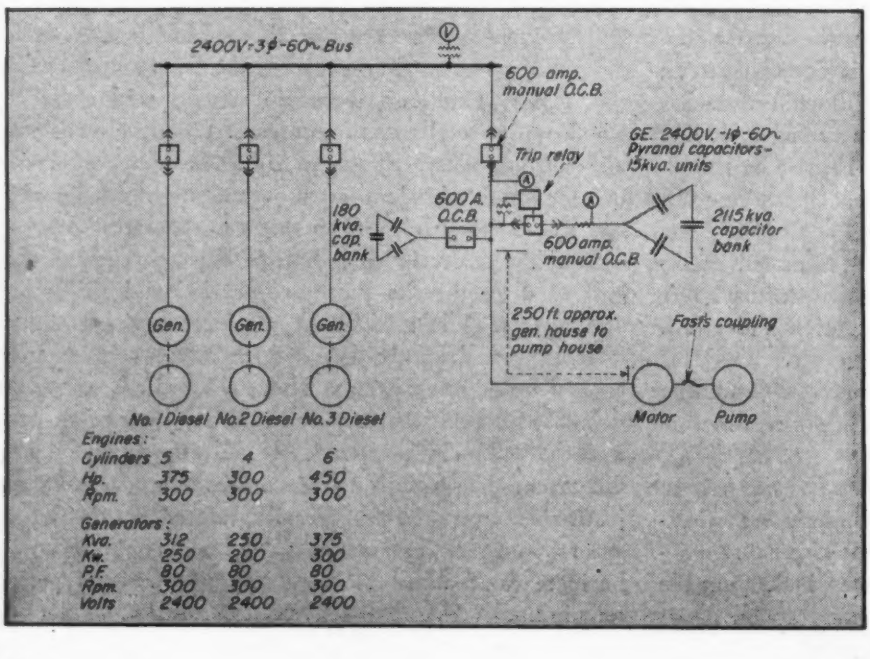
By J. M. EVANS
Supervising Electrical
And Mechanical Engineer,
Naval Area VI, San Francisco

THE AMOUNT of generator capacity required to start a given size induction motor has been the subject of much academic discussion. Practically, the problem arose during the latter stages of the war when an 800-hp., 3,575-rpm., 2,400-volt, across-the-line starting squirrel-cage motor was installed on a government research project. The motor was to drive a 1,000-hp., 3,600-rpm., 1,500-psig., 864-gpm. centrifugal pump. Insufficient capacity in utility lines at the point made it necessary to install three diesel-engine-driven units, consisting of one 200-kw., one 250-kw. and one 300-kw. machine, totaling 750 kw. at 2,400 volts, 0.8 power factor. The many troubles of getting a heterogeneous array of equipment in operating condition were incident to the question of whether the motor would start with total generator rating so nearly matching motor size.

A telephone line was run to the motor where an observer was posted. The pump required approximately 100-lb. positive pressure. Accordingly, the low-pressure pumps were started and oil was circulated through the high-pressure pump and bypass. All air was bled from the system and the signal given to start the motor. Everything was right except that the motor attained a speed of 500 to 600 rpm., approximately one-sixth of synchronous speed, but could not further accelerate. The generator bus had dropped to 800 volts with an output of 280 amp. Examination of the motor curves showed that starting torque with 2,400 volts impressed would be 75 percent of full load torque, and dropped to 47 percent full load torque at two-thirds synchronous speed with 2,400 volts impressed, before a quick rise to full load.

The power factor curve of the motor is quite arresting. At start, the power factor at 2,400 volts is 12 percent, but at two-thirds synchronous speed it has fallen to 9 percent. With these known facts it was evident that at speeds between 500 and 2,400 rpm. the pump required greater torque than the motor possessed at the reduced voltage which the generators produced.

SIMPLIFIED DIAGRAM of electrical circuits involved in using capacitors to start 800-hp. motor with 750-kw. generator capacity



Remedial Measures

Several methods of accelerating the motor were considered:

1. Slow down the prime movers. Start the motor on the reduced frequency and then bring the diesels up to full speed.
2. Install a hydraulic clutch.
3. Install a magnetic clutch or simplified dynamometer, and
4. Use capacitors.

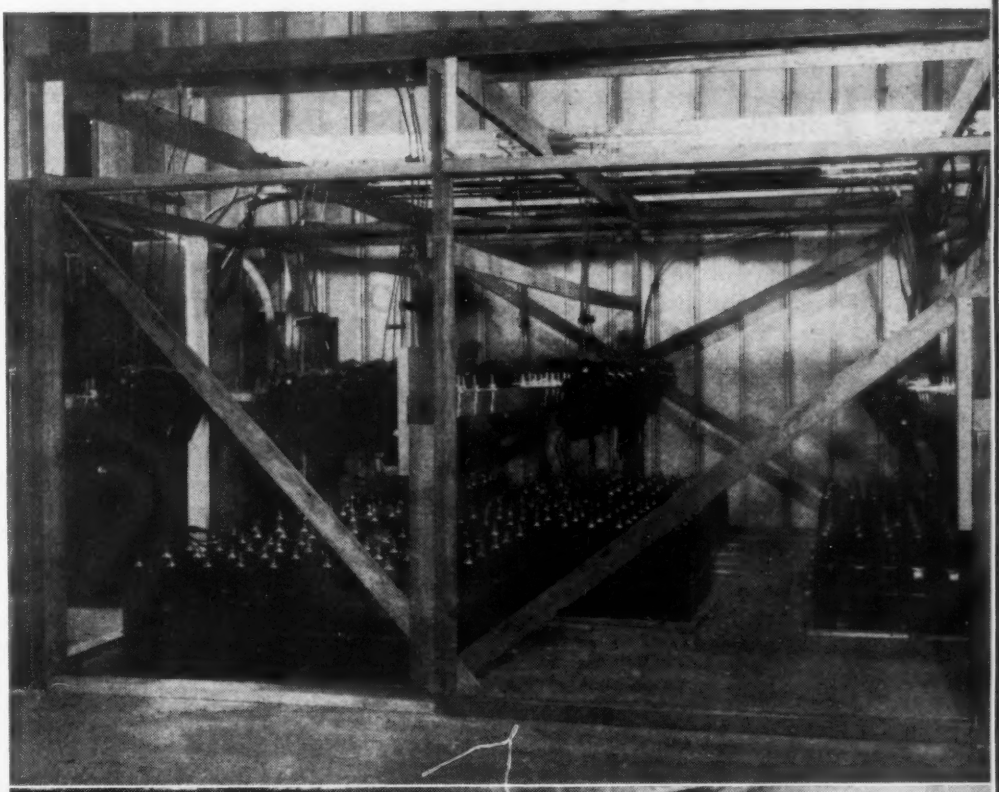
It was obviously impracticable to slow down the three diesels and then attempt to hold them in synchronism as the speed was increased. No 800- or 1,000-hp., 3,600-rpm. hydraulic clutch had been developed, but if known principles would hold at the higher speeds and materials could be assured, delivery could be made in eight months to a year. A magnetic clutch could have been used but since the expense would have been greater than for a hydraulic clutch, this idea

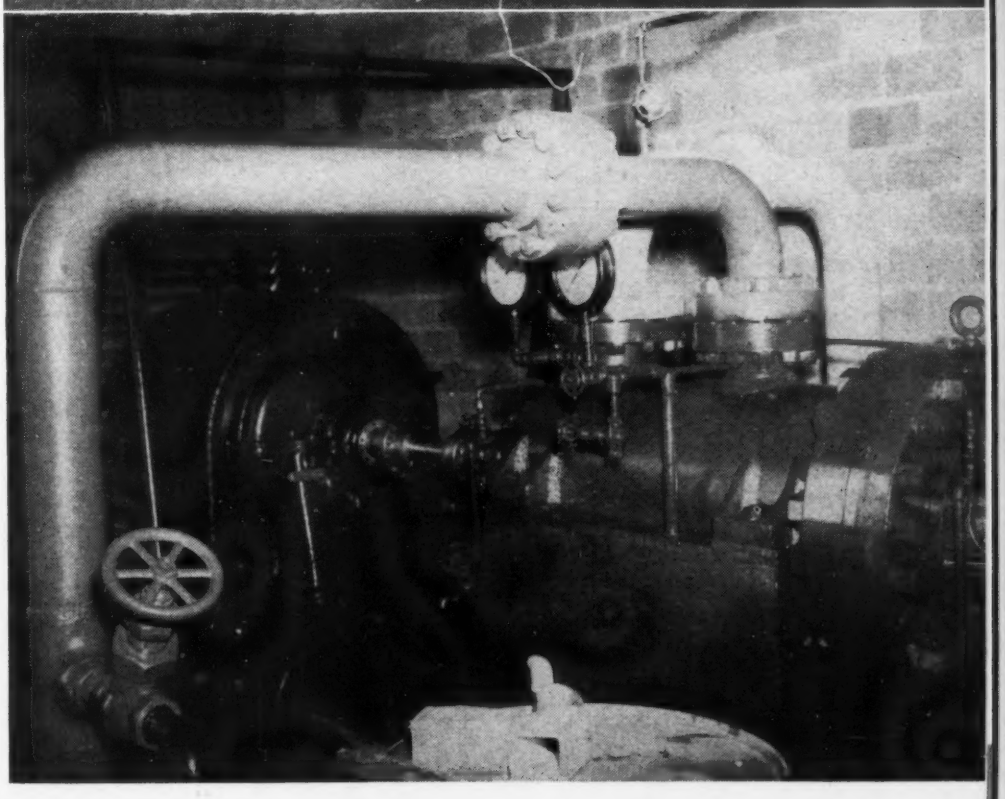
with 750-Kw. Generator

was eliminated. Capacitors were available and the expense would be less than 10 percent of either of the other two practicable methods.

Pick Size By Trial

It was decided to determine by trial the capacitance required. Each time that additional capacitors were added, the voltage rose higher, the current became larger and the speed greater. It was found that with 1,950 rkva. the motor pulled into step but it took too long to do so. Fifteen seconds' accelerating time was set as the minimum practical limit for inertias as large as the pump-motor combination and 30 sec. as the upper limit. When the capacitance was 2,295 rkva., the time for pull-in was 18 sec., which was quite satisfactory. To help out the generators as much as possible under full load conditions, 180 rkva. was put on a circuit breaker that could be left on the line. The other capacitors were on a circuit breaker that could be opened at the proper time. The voltage rose so rapidly with the capacitors on the line that it was impractical to manually trip the controlling breaker. A voltage relay set to trip at 10 percent overload did the work quite satisfactorily. The accompanying simplified single line diagram shows the electrical connections.





CAPACITOR INSTALLATION—2,295 rkva. in static capacitors made possible starting 800-hp. induction-motor-driven centrifugal pump with 750-kw. generator capacity. Without capacitors, voltage on 2,400-volt bus dropped to 800 volts and motor stalled at 500-600 rpm (top)

MOTOR DRIVEN PUMP—motor would not accelerate with limited generator rating available. Use of hydraulic clutch or magnetic clutch to solve problem was discarded in favor of less expensive capacitor installation (right)

Sensible Pattern of Voltages For Apparatus Standardization

THE PUBLISHING of the Interim Report (November, 1946) by the E.E.I.-NEMA Joint Committee on Preferred Voltage Ratings for A.C. Systems and Equipment is the result of eight years of study of system data and apparatus characteristics. This Interim Report brings up to date the original report on this subject, which was published by the same sponsoring groups in 1930. The Interim Report represents the cooperative efforts of the two sponsoring organizations and their many interested members and committees, as well as many interested engineers throughout the United States.

Scope of Report

The scope of the activity, as outlined in the Interim Report, is:

"The scope of the joint committee is to establish nominal voltages of alternating-current electricity supply systems above 100 volts and preferred voltage ratings of all electrical apparatus connected to those systems from the utilization equipment to the generators."

The Report just published, E.E.I. Publication No. 0-10 and NEMA Publication No. 113, outlines the broad concepts of the work and gives specific data on systems and apparatus up to and including 15 kv. The Joint Committee has also just released a Preliminary Report covering the range from 15 to 230 kv., which is being circulated for comment and constructive criticism. Work has also been undertaken by the Joint Committee on the selection of voltages above 230 kv. This is still in the Committee stage.

The Interim Report referred to above for voltages up to 15 kv. has been released for a probationary period of one year, at the end of which time the comments received will be taken into consideration by the Committee and a final report will be prepared. Likewise, the Preliminary Report for voltages from 15 to 230 kv. is being circulated for immediate comment and criticism before the preparation of a final report. The Committee cannot too strongly emphasize the fact that these reports are being circulated for study and comment.

Objectives

The ratings proposed in this Report do not constitute standards. It is not within the scope of this Committee to establish standards. It is intended, however, that these recommendations will form the basis of standardization for the other committees who have that function in connection with specific classes of electrical equipment, such as transformers, breakers, etc.

Before undertaking the revision of the 1930 Report, the Committee felt the need of a statement of objectives. The objectives set down in the Interim Report are as follows:

(a) Promote a better understanding of the nature of the voltages which exist on power systems for practical and economical operation and which equipment should meet.

(b) Establish uniform nomenclature in the field of voltages and reduce the number of nominal system voltages.

(c) Indicate suitable zones for the voltage spreads of operating systems and promote more general conformance with them.

(d) Indicate relationship between equipment ratings and conditions which they are expected to meet in service.

(e) Provide a guide for future development and designs of equipment to the best possible conformance with the needs of the users.

(f) Promote standardization of equipment by reducing variety of ratings that are presently in use.

(g) Provide a guide for new power

CLARIFYING CONFUSED VOLTAGES

CULMINATING an effort originally initiated 17 years ago, a joint committee of the Edison Electric Institute and National Electrical Manufacturers' Association has recently promulgated a new interim report entitled "Preferred Voltage Ratings for A.C. Systems and Equipment." It represents eight years of renewed activity aimed at clarifying a confused situation as to voltages second only in industry significance to that which existed before 60 cycles became virtually the national standard for power systems, replacing a welter of frequencies that ranged from 15 to 133 or even more cycles per second.

In view of the long-range benefits derivable from full realization of the greatly reduced number of voltages, ELECTRICAL WORLD presents the following interpretation prepared by H. P. Seelye and A. C. Monteith on behalf of the two groups which collaborated with them in the joint activity. Complete appreciation of the potentialities of the recommendations can only be obtained by study of the interim report and it is hoped that this will be the result of this presentation, so that the committee will have the comments of wide sectors of the industry toward preparing its definitive report—*Editors*

system undertakings and also for changes in old ones in their choice of voltages.

(h) Make available a source of educational information in the field of voltages.

It may be asked, "Why do we need any further standardization of voltages in view of the considerable amount of standardization that already exists, and why not leave voltage standardization to these other committees who are working on standards for equipment?"

Joint Committee proposes for industry study reduction in number of prevailing voltages up to 15 kv. to be used in fixing standards for equipment at point of utilization, at distribution transformer and at substations

Two Questions Answered

The answer to the first question is that although there does exist a good amount of standardization of voltage ratings in the industry, there are a number of situations in which a lack of definite and accepted standards is costing the industry a large amount of money. Furthermore, and this also answers the second question, there is a need for a coordination of the voltage ratings of systems and of the various classes of apparatus which can best be done by a committee specifically assigned to the task than by the various organizations working on special projects.

Clarification Needed

Specifically, some of the things needed are as follows:

There has been a great confusion of names for the voltages we are using. The voltage delivered at lamp outlets throughout the country lies, for the most part, between certain reasonable limits within which most of the lamps and appliances function very well. The systems are variously called 110-volt, 115-volt, and 120-volt systems, however, and sometimes even by other names. They are essentially similar systems even though some may have a little higher average level than others. There has been no general understanding as to how apparatus should be rated for use on these systems, although obviously a piece of equipment should be usable anywhere if possible. Furthermore, there

SYSTEM VOLTAGES

(*Not to be considered as design limits for specific types of equipment*)

Ratio of Preferred Nominal System Voltage to 120	Preferred Nominal System Voltage	Voltage Zones			
		Favorable Zone		Tolerable Zone	
		Minimum	Maximum	Minimum	Maximum
VOLTAGES AT POINT OF UTILIZATION BY EQUIPMENT					
1/2	120/240	110/220	125/250	107/214	127/254
1/1.73Y	120/208Y	114/197Y	125/217Y	111/193Y	127/220Y(c)
2	240	210	240	200	250
4	480	420	480	400	500
5	600	525	600	500	625
20	2,400	2,200	2,450	2,100	2,540
20/34.6Y	2,400/4,160Y	2,200/3,810Y	2,450/4,240Y	2,100/3,630Y	2,540/4,400Y
40	4,800	4,400	4,900	4,200	5,080
60	6,900(b)	6,300	6,900	6,000	7,200
	7,200(b)				
PRIMARY VOLTAGES AT DISTRIBUTION TRANSFORMERS					
20	2,400	2,300	2,500	2,200	2,600
20/34.6Y	2,400/4,160Y	2,300/4,000Y	2,500/4,330Y	2,200/3,810Y	2,600/4,500Y
40	4,800	4,600	5,000	4,400	5,200
60	7,200	6,900	7,500	6,600	7,800
40/69.3Y	4,800/8,320Y	4,600/8,000Y	5,000/8,660	4,400/7,620Y	5,200/9,000Y
100	12,000	11,000	12,500	10,500	13,000
60/103.9Y	7,200/12,470Y	6,900/12,000Y	7,500/13,000Y	6,600/11,450Y	7,800/13,500Y
63.5/110Y	7,620/13,200Y	7,270/12,600Y	7,960/13,800Y	7,000/12,100Y	8,250/14,300Y
110	13,200	12,600	13,800	12,100	14,300
120	14,400(d)	13,000	14,500	12,600	15,000
VOLTAGES AT SUBSTATIONS AND ON TRANSMISSION SYSTEMS					
20	2,400	2,300	2,600	2,200	2,750
20/34.6Y	2,400/4,160Y	2,300/4,000Y	2,600/4,500Y	2,200/3,810Y	2,750/4,760Y
40	4,800	4,600	5,200	4,400	5,500
60	7,200	6,900	7,800	6,600	8,250
40/69.3Y	4,800/8,320Y	4,600/8,000Y	5,200/9,000Y	4,400/7,620Y	5,500/9,520Y
100	12,000	11,000	13,000	10,500	13,200
60/103.9Y	7,200/12,470Y	6,900/12,000Y	7,800/13,500Y	6,600/11,450Y	7,920/13,700Y
63.5/110Y	7,620/13,200Y	7,270/12,600Y	8,250/14,300Y	7,000/12,100Y	8,320/14,500Y
110	13,200	12,600	14,300	12,100	14,500
120	14,400	13,000	15,000	12,600	15,500

NOTES:

(b) Since utilization at this level is confined principally to 6,600-volt motors in large steel mills, mines, etc., a nominal designation of 6,900 volts is commonly used and is included herewith, even though it is not consistent with other nominal voltages in the utilization group. The voltage zones for this level are likewise related to 6,900 volts rather than to 7,200 volts.

(c) Equipment to be used on both the 120/208Y- and the 240-volt systems must recognize the minimum voltage of the former and the maximum voltage of the latter.

(d) 14,400 includes many systems which have been called 13,800, and the voltage zones are correspondingly lower.

(e) Equipment designed for the Favorable Zone will in general give fairly satisfactory operation throughout the Tolerable Zone, except that modification of loading or alternate designs may be required for certain types of equipment.

has been some tendency for these voltages to "inch up" in places and there has been a fear that this might eventually make the situation still more confused.

Tolerable and Favorable Zones

We have set down in our Table I the range of voltages which we have found by surveys of the industry to include most of those actually being delivered to customers in common practice. We have named a Tolerable Zone, which covers not only those most used but the smaller percentage of higher and lower values, which are giving fairly good results with present equipment. We have named a Favorable Zone which includes the narrower range of voltages most often found. These ranges define the system. We have called it a 120-volt system. Any system whose operating voltages lie within these zones could be so-called.

The Favorable Zone is narrow enough that most of the equipment can be made to give satisfactory operation throughout it. Much of such apparatus will still operate with fair satisfaction when necessary in the higher and lower values of the Tolerable Zone. We specifically do not offer these zones as ratings for apparatus—such ratings are given in other tables of the report. They are guides to the conditions under which apparatus is being used in the industry. They offer the manufacturer a basis upon which he can make his design with confidence, provided operating systems strive to maintain their voltages accordingly. Thus, equipment made for the zones of 120-volt systems, as here defined, can ordinarily be used on any such 120-volt systems regardless of their variation in measured voltage or in average levels within these zones.

Higher Voltage Level

Similar zones based on existing practice have been set down to define various higher voltage levels up to 14,400. Each level has been named by a multiple of 120 volts, either because such a value is already in common use, such as 2,400, or because it is closely associated with one in common use, such as 120/240. Confusion in names and, hence, in ordering equipment, can only be avoided by the general acceptance of single common nominal designations for each level such as these.

Appliance Field

In the appliance field, there is a large amount of confusion in ratings due to the various nominal designations in use and to the characteristic variation in the voltages most frequently supplied to different types of equipment. In Table II, we have attempted to systematize these ratings so that similar pieces of equipment will have the same rating. These are not all coincident with nominal system voltages, since existing standards are recognized as far as possible, but they are all indicated as suitable for the same nominal system. We have also indicated the votages which are most commonly applied to the apparatus, as a basis for its design, taking into account the voltage drop which its own current produces, the time of day it is likely to be used, its desirable life, etc.

Motor voltage ratings are pretty well standardized in the industry and we have proposed no important changes. We wish to make it clear, however, that motors rated at 220 volts are generally applicable to any 240-volt system as we have defined it, and similarly for other levels.

Generator ratings have been quite various in the range above 10,000 volts. By an industry survey, we established the acceptability of four standard ratings for this range, the accent being on the most common one, 13,800 volts.

Switchgear and Transformers

In switchgear there has been some difficulty with the fact that ratings have been based on maximum operating voltage which in some cases has not been high enough for the systems whose nominal voltages have seemed to be included. We are proposing that circuit breakers be rated according to nominal system voltages and that maximum operating voltages be, in general, sufficient for the Tolerable Zone.

Distribution Transformer Voltage Ratings have already been well worked out by the E.E.I.-NEMA Joint Committee on Distribution Transformer Standards. We have incorporated these in our report. Ratings for Power Transformers are not given in this Interim Report, but a definite recommendation, which should go a long way to clear up the present multiplicity of ratings and taps, has been sent out to the industry for comment.

Our Report covers other types of equipment in a similar fashion. In general, we have retained present ratings where they are well established. We have proposed certain changes where it was felt they would lead to eventual economy by reducing the number of variations necessary or by better suitability to the system voltage zones. Each item has been carefully studied in an attempt to find the best answer for all parties concerned. In general, the aim has been to make the recommendations cover as many of the existing operating conditions as possible and at the same time point the way to simplification and standardization of apparatus rather than setting up certain restricted values as preferred models.

A Guide to Simplification

This whole discussion may be summarized by saying that the work of the Joint Committee has been an attempt to offer a reasonable guide to standardization of system and equipment voltages, wherein the diversity of operating conditions and practices on systems is given full recognition, and the inherent limitations of design and manufacture of apparatus have also been fully taken into account. It was hoped that it might include the greater part of the essential requirements of the operating systems of the country by making the recommendations as broad as possible, thereby allowing adequate freedom for development and economy. It was also hoped to promote the standardization and reduction in variety of the equipment ratings needed for these systems by indicating as definitely as possible the range of conditions to be met, and at the same time by not suggesting voltage ranges which are beyond the possibility of economical design. It is recognized that the full acceptance and realization of such a program as this will take some time if disproportionate costs for changeover and development are to be avoided. It can only be accomplished by the full understanding and cooperation of all those concerned, both manufacturers and users. Such cooperation is earnestly solicited by the Joint Committee.

SEASONAL LOAD SPREAD

Is It Enough for Maintenance?

Study of characteristics of postwar seasonal land curves by ELECTRICAL WORLD shows that some have not reverted to prewar spreads between winter and summer peaks. Maintenance of generating facilities is somewhat cramped as a result. More generous reserve percentages than prewar, however, are promised for the future. Survey replies show little interest in unorthodox forms of generation for outlying areas and no sign that load building will be molded to fit maintenance needs. Full scale sales programs, however, await adequate capacity.

ARCHER E. KNOWLTON, Associate Editor

THE WAR changed the system load curves in a profound manner but to a considerable extent they have resumed their pre-war characteristics. In some instances there have been, however, appreciable changes in the contours, the time and duration of peaks, the spread between maximum and minimum annual loads. Survey indicates that these changes are accentuating the general insufficiency of capacity insofar as they afford fewer and shorter opportunities to perform scheduled maintenance. A sizable group of companies say they will have to increase the former customary percentages of reserve in order that maintenance of generation facilities can be carried out comfortably and they attribute this to less favorable configuration of their seasonal load curves.

This conclusion comes from studies of load curves and comments from 41 utilities with a total of practically 23,500,000 kw. of capacity and with a 1946 output of 95,000,000,000 kw.-hr. The report thus represent about 45 percent of the industry.

Salient points deduced from the survey are:—

1. Some areas will need additional capacity above that required for normal peak protection in order that normal maintenance can be performed.

2. Half the utilities find, however, no increased difficulty in doing major seasonal maintenance.

3. Some among the others have experienced a shrinkage of winter-to-summer spread with progressive obstacles to doing major maintenance work.

4. For these situations the post-war reserve percentages will be aimed higher than pre-war values.

5. Some peaks are sharpening, others broadening, accentuated by abrupt weather conditions.

6. Minor maintenance capable of week-end execution is being facilitated by the comparative easing of Saturday loads.

7. Inadequacy of capacity is a widespread, almost universal, condition.

8. Air conditioning makes the peaks in Southern areas.

9. Sharp weather changes are getting to be a larger factor in establishing peaks at unexpected times.

10. Tendency toward concentration of larger capacity in single units is somewhat a factor in putting a pinch on maintenance.

11. For several companies their interconnections will permit continuation of local pre-war reserve percentages as normal margins are reestablished over the pool.

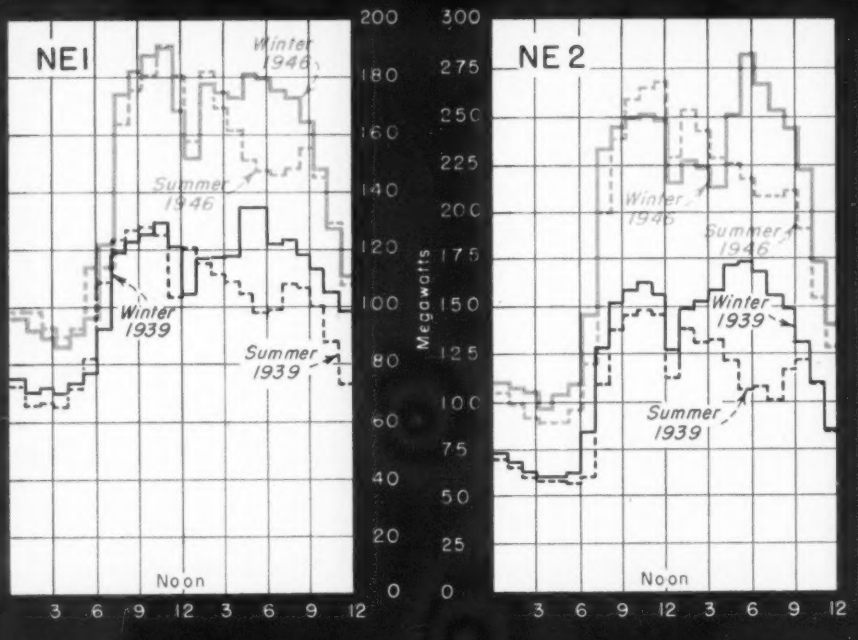
12. In only a few areas is it considered that the potentialities for fruitful interconnection have already been exhausted.

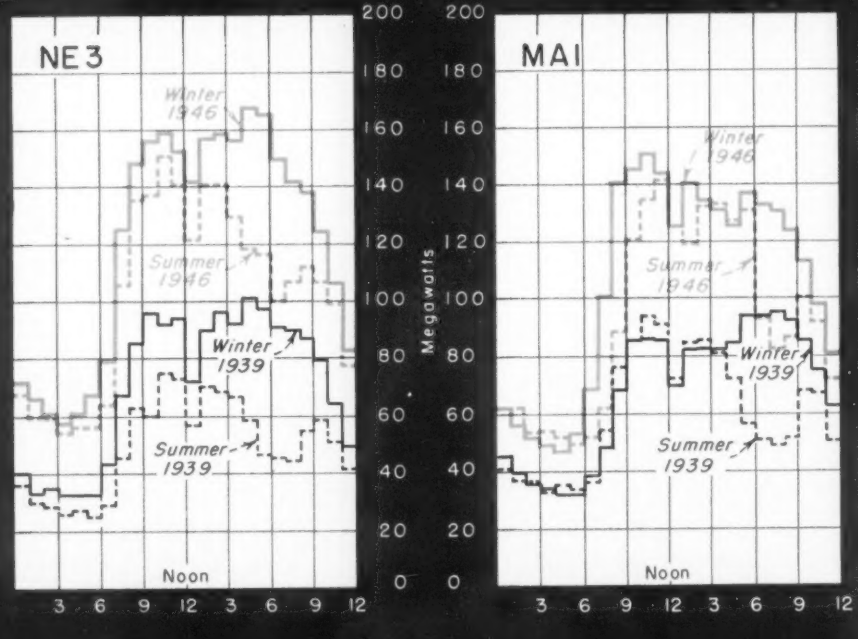
13. There is almost negligible national interest in mobile, peak-load or emergency generation for outlying areas.

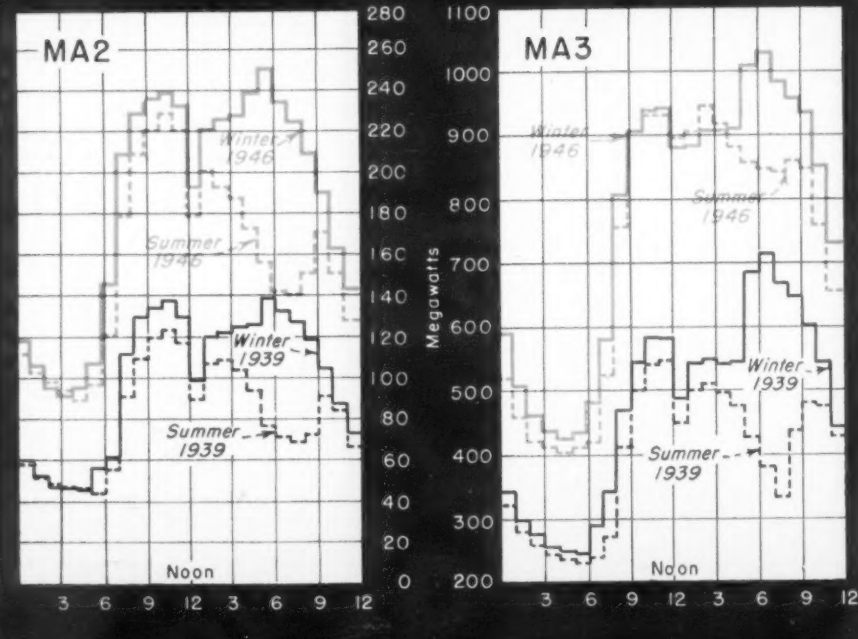
14. Hardly any company will cut its load-building cloth to fit its generating-capacity pattern just to insure depth of valleys sufficient to permit easy maintenance.

15. There is uneasiness about the impact of electric house-heating.

16. Full-scale load-building programs are awaiting the acquisition of an assuring amount of reserve generation.







CYCLE OF PEAKS

BETWEEN 1939 AND 1946 there have been some utilities that experienced a change in the period of the year when the system peak occurred, but the great majority of utilities say that the months are practically the same for both pre-war and post-war loading. Several mention substantially greater proportion of industrial load (e.g., 45 percent to 60 percent) assuring a continuance of the December-January peaks as being the annual system peaks. Half a dozen responses emphasize the influence of weather, particularly sharp cold snaps or sudden dark days, in fixing the actual month in which the peak, usually summer or fall, occurs. From the maintenance standpoint these are evidently viewed as quite disturbing factors especially where the spread between summer and winter peaks has already narrowed; this is discussed elsewhere in more detail.

Utilities in the Southern tier naturally have peaks definitely related to the air-conditioning load. Prospect of substantial increase in this load prompts a South Atlantic and an East North Central utility to expect a shift of their present winter peak to summer time. One company expects this shift to be further accentuated by superposition of the unpredictable dark summer day loading on the rising air-conditioning load.

Shape of the Peak

The war brought a pronounced change in duration of peak but three-fourths of the reporting utilities say the 1946 characteristics of the daily load curves reverted substantially to the behavior of the pre-war period typified by 1939 experience. The intensive and around-the-clock loading of the war appeared and disappeared with the principal residual a greatly increased load. There are notable exceptions, however, and one is an East North Central utility conscious of a moderate tendency for the daytime peaks to broaden. A West Coast company finds the peaks broadened possibly due to a rate policy which has stimulated daytime lighting or maybe only prompts users to be less

VS. MAINTENANCE

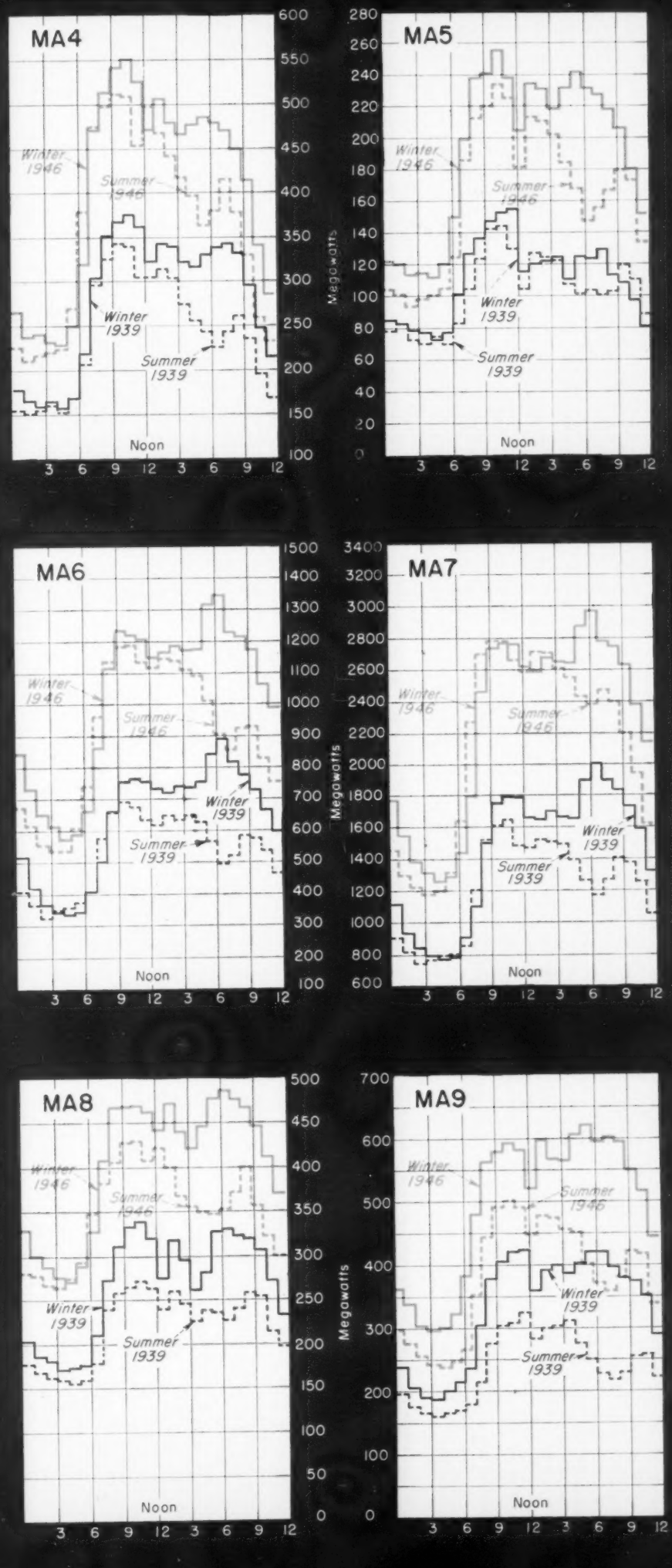
eager to confine the lighting to dusk and evening hours. Broadening in a New England and a Mountain instance is attributed simply to proportionate increase in the industrial load. At this point a Southwestern and a Pacific utility sense a degree of broadening further due to increase in refrigeration and air-conditioning loads along with the industrial.

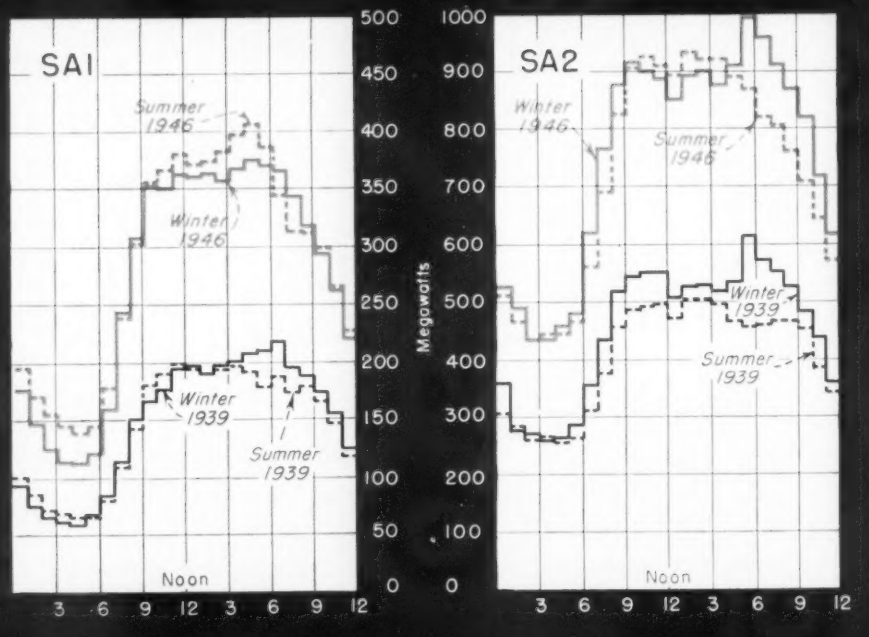
Contrasting with those finding no significant change or even a degree of broadening are a couple of utilities that report an unmistakable 1946 tendency for the peak to sharpen although both attribute it in part to intervention of storm loading.

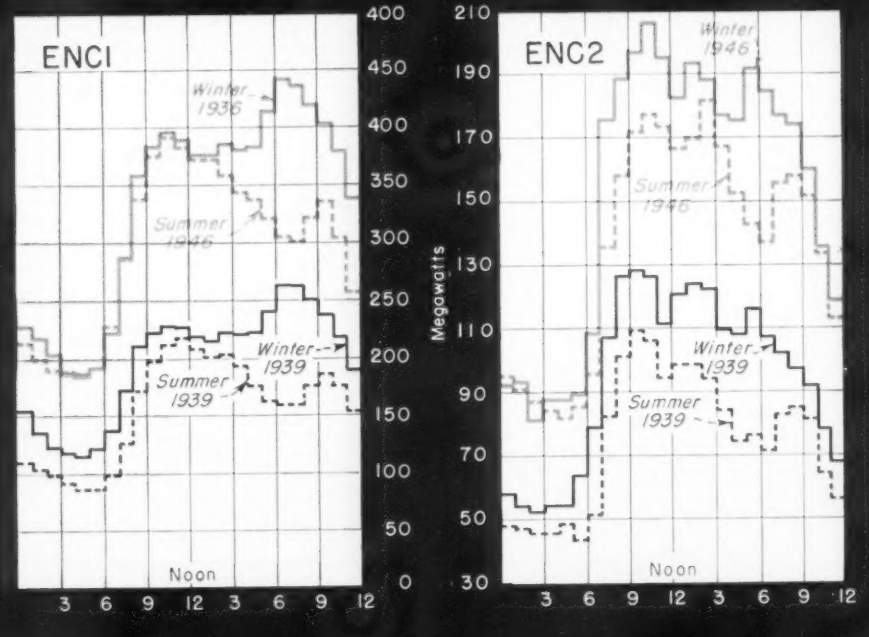
Half the utilities, broadly speaking, report that there is no greater degree of interference with desire to perform maintenance now than there was before the war and this includes both short-time, week-day and week-end jobs as well as the longer maintenance outages done on a seasonal basis. Such difficulties as are encountered by this group are attributable more to the growth in load without corresponding increase in capacity than to changes in character of the load curves. Somewhat out of line with the whole group are two companies (one Middle Atlantic and one Pacific) that even report more seasonal spread and somewhat greater ease to perform maintenance now than before the war.

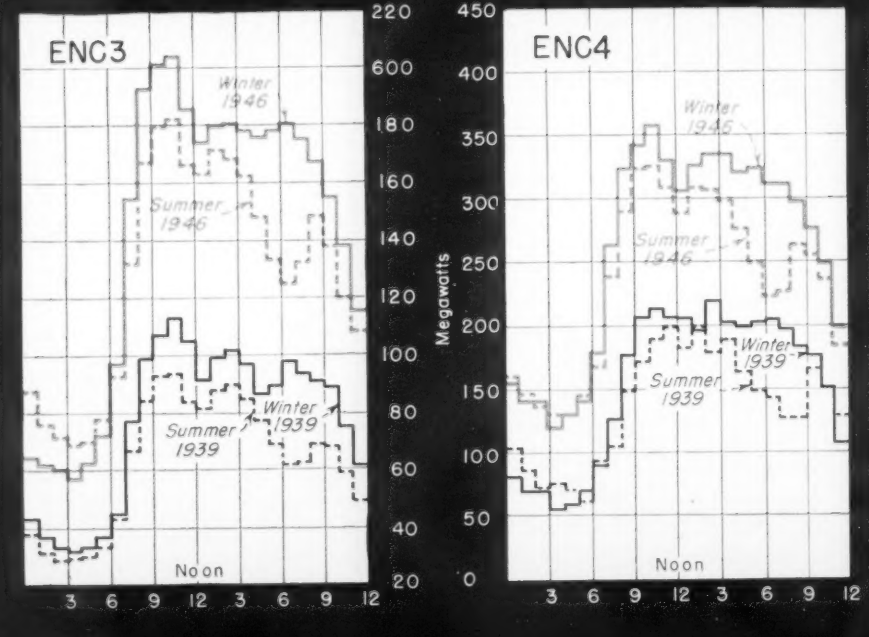
Less Seasonal Spread

The seasonal maintenance situation is the one that reflects the most positive indication that year-round loading changes are causing a pinch that will only be eased when more general reserve capacity is provided. The difficulties as reported range from prospective and slight to what appears to be reasonably critical. Four utilities, well scattered, say the seasonal spread has definitely decreased and there is less opportunity afforded for maintenance of major equipment. One in particular describes it as due to an evolving situation in which more months of the year approach the peak month in load characteristics leaving a lesser period in which









major overhauls can be carried out. Another expresses it this way—"A substantial maintenance problem exists and it appears probable that the companies in the region will need to install more capacity than that required for normal peak protection in order that normal maintenance can be carried out." Still another, a Western utility, says it is so "squeezed for capacity" that considerable difficulty is being experienced in conducting seasonal maintenance schedules. In another area (East North Central) a utility relates its own stringency to the capacity requirements of companies with which it is interconnected—a situation reflected in many more instances than those in which it was mentioned. A West Coast utility, in fact, points out that the margins of the interconnection as a whole rather than any local spread between maximum and minimum hours are what dictate the maintenance periods.

The Week End Repair

Only for three companies (one Middle Atlantic, one South and one Pacific) is there reported tightness in connection with week-end maintenance. The former cites the increase in Saturday loads as interposing the difficulties. On the contrary another Middle Atlantic utility and one from New England state that week-end repairs are comparatively facilitated because Saturday loads are lower now than before the war relative to the week-day loads. In general the answer was a simple "no" or "no change" to the query whether decrease in spread between maximum and minimum was now hampering week-end maintenance operations.

In connection with condenser cleaning and other short-time maintenance operations nearly two-thirds of the reports indicate no difficulties in connection with these day-to-day activities because there is enough slack at night to afford ample opportunity. A West Coast utility even stated that the spread is greater now than in 1939. Several utilities did, however, indicate that sustained load factor or load growth were not only preventing desirable maintenance but creating the occasion for increased attention to the equipment. This is, of course, a reflex of the broader question—are reserves adequate?—next to be discussed.

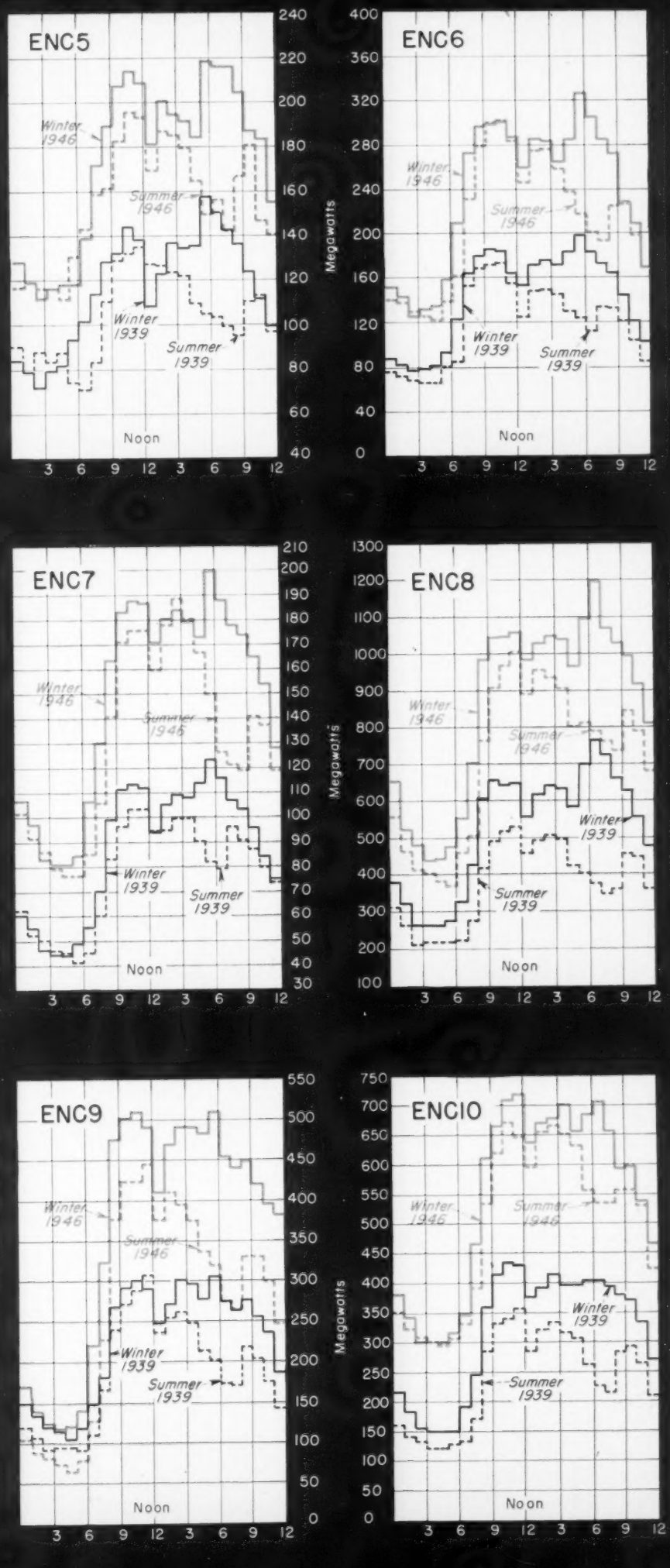
Adequacy of Reserves For Maintenance

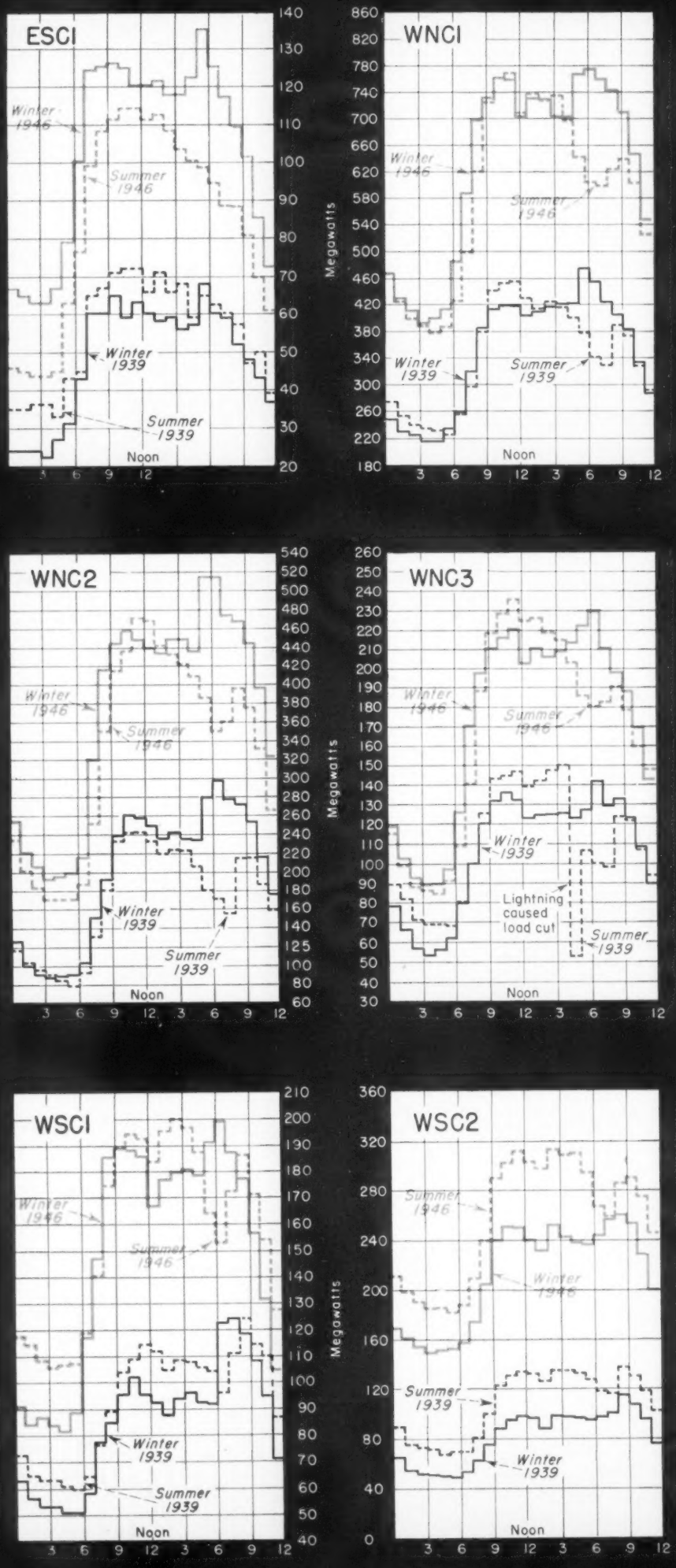
Inadequacy of capacity is an almost universal indication, only three utilities asserting that they have sufficient generation. The specific issue raised was, however, whether some increase in reserve percentage is considered necessary (over and above reserves against emergencies and mishaps) to permit comfortable maintenance. In other words, has the seasonal spread closed in to such extent that pre-war margins of reserve would be insufficient to afford requisite opportunity for overhauls as well as to meet the hazards of operation?

There is widespread feeling that the answer will have to be an increase to accommodate maintenance. It is substantiated by such expressions as the following:—

"Probably will have to increase to cover maintenance." "It is expected that an increase in pre-war reserve standards will be made to permit comfortable maintenance." "Normal reserves provide for emergency outages, load estimating errors and scheduled maintenance; indications are that a combination of (1) decreasing seasonal variation in load plus (2) the installation of larger generator and boiler units will necessitate increased reserves to permit comfortable maintenance." "While formerly one unit above peak load was considered adequate today's loading conditions and year-round maintenance schedules may require two-unit reserve." "For the combined system (Eastern) there has already been an increase in the reserve percentage above that for emergencies and mishaps to permit comfortable maintenance and further increase may be required for the future." "It is the plan to increase generating capacity to the point where adequate reserves are available to provide routine maintenance and a reasonable amount of emergency maintenance."

How much this increase is likely to be is not generally expressed but one response was quite specific in this respect—"Percentage of reserve capacity in the pool should be increased; studies point to an increase in the over-all reserve (covering emergency, mishaps and maintenance) of from 8





percent of capacity to 12 percent of capacity."

On the contrary there was a large group of companies which indicated that, in view of their interconnections, pre-war margins of reserve would be sufficient. Right now those margins exist at hardly any points and the effort is being made to restore them promptly.

Supplemental Generation

Such interest as there may be among electric utilities in special generating facilities devised for casual, breakdown or mobile service is manifestly very limited. In fact, 27 utilities simply submitted an unqualified "no" in answer to all three questions —namely, were the present load and capacity circumstances prompting consideration of (1) outlying peak-load generating units, (2) outlying emergency generating units, (3) mobile generation.

Only one utility (Eastern) evinced a positive interest in generating capacity conceived primarily for peak-load use. The reply is so specific that it is given verbatim. "We are convinced that pushbutton gas turbines are (to be) feasible in the near future; they would be used for semi-peak loads at the ends of lines, thus saving additional transmission to distant points." Far less affirmative are replies which say "not at present" or "studies not yet complete," implying a possible future interest.

Much the same attitude holds with regard to units placed in outlying districts solely to function in case of transmission breakdown except that there was no company expressing as positive an interest as in the case of units to be used quite regularly on peaks.

Fringe Capacity

On the whole, the interest in self-contained boiler-turbine units, diesels, gas turbines, automatic hydro, etc., seems to be aimed at full-scale application rather than restriction to peak or breakdown service.

Nor is there any discernible interest in mobile, rolling, or floating generation although again a couple of companies say "not at present" or "studies incomplete." One West Coast utility is still using the stern portion of an electric-drive tanker (that broke in two in the Aleutians)

to supplement the supply to an outlying area.

As to further interconnections the situation is wholly different. Only a third of the responses show no intention to engage in further connections or expanded pooling. A few more say the potentialities in their area for interconnection have been practically exhausted, meaning that all available facilities have already been pooled. Of course this does not run counter to the current extensive program of building lines to effect connection with additional generation facilities as they mature.

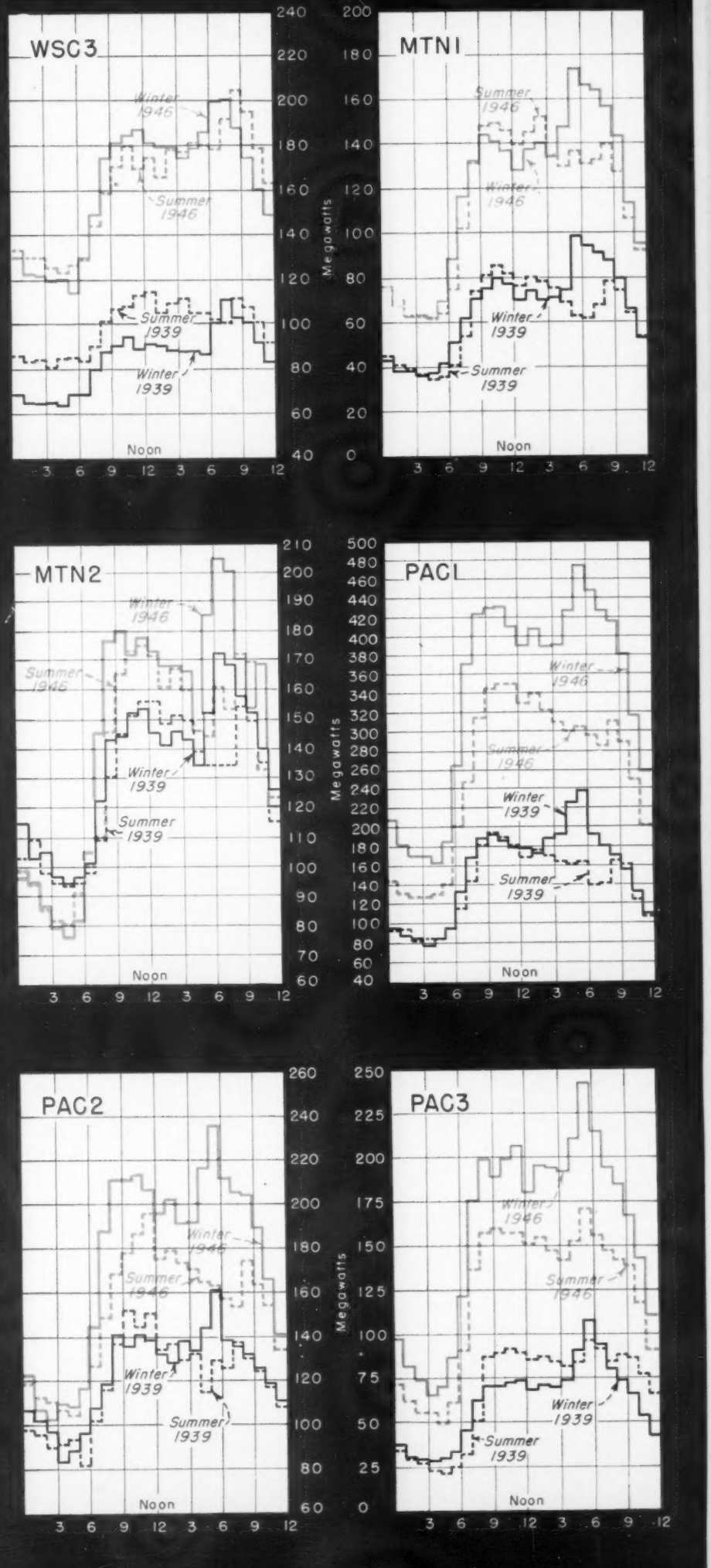
Load-Building Programs

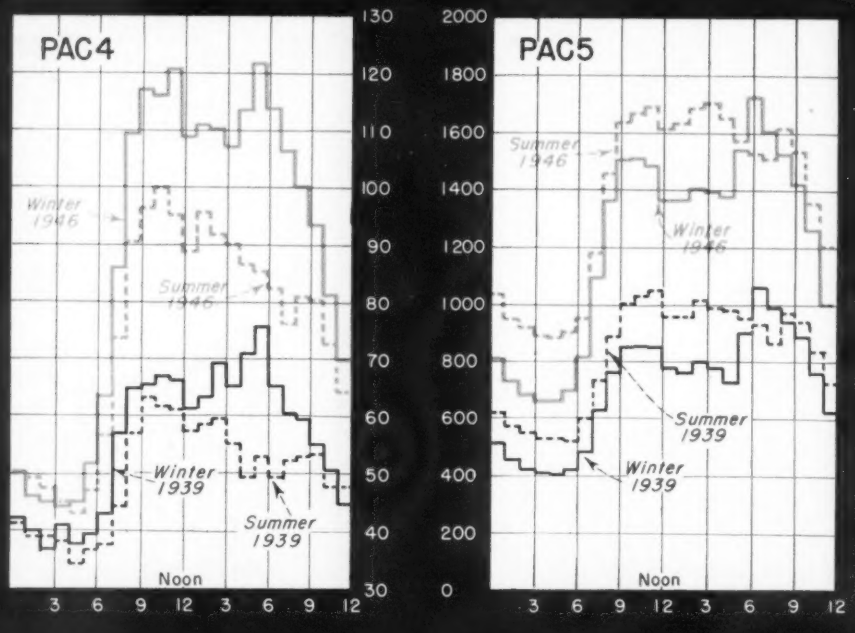
Has such change in the shape of load curves as has occurred resulted in modifications of program for stimulating use by customers? Survey replies indicate that the answer is "no." In other words, there is practically no determination to do more than defer intensive load-building activity until a safe margin of capacity can have been provided. There is no discernible sentiment for focussing on loads which would be of such character as to preserve the spread between maximum and minimum loads so as to facilitate maintenance of generating facilities that are in need of attention.

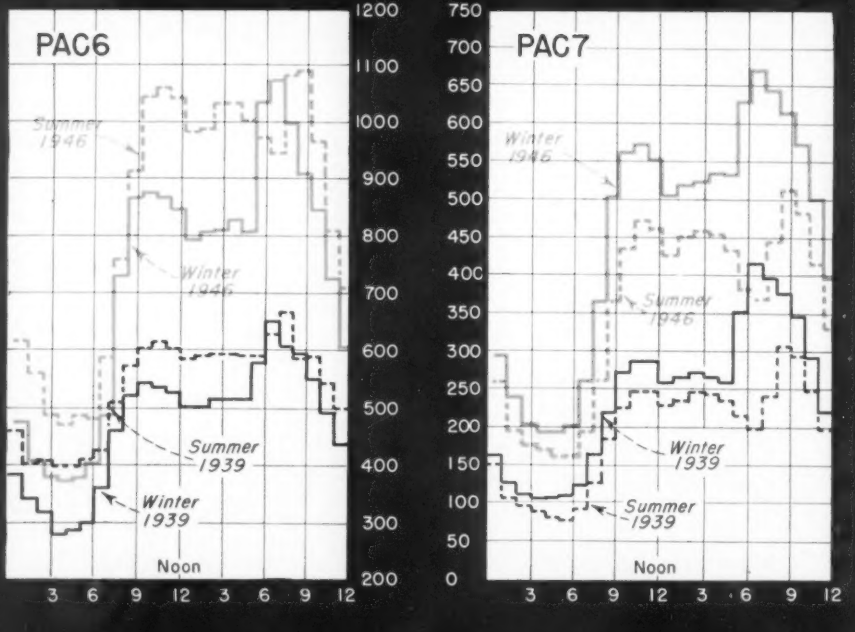
Two-thirds of the companies indicate "no change" or say the change in the system load cycles is too slight to warrant recognition in shaping the load-building programs and objectives. It is more the general insufficiency of capacity on the peaks that is resulting in a deferment of activities or at best a present program of long-range education as contrasted with any effort to attach immediate loads.

Selective Valley-Filling

Such selectiveness as is indicated comprises the customary valley-filling ones of water heaters and air-conditioning installations. One company reports attempts to increase load during daily off-peak hours through an industrial rate schedule designed to encourage two-shift or three-shift plant operation. As another puts it, "we still need more graveyard loads" and as a third expresses it, "most of the load building activities will be directed to improve the system load factor with consequent reduction in







average cost of energy to all users."

From this point of view all valleys —daily, weekly or seasonally—are uneconomic and therefore should be filled. Conversely the valleys are the salvation of the operating men because they afford the slack for maintenance as well as for tolerating unforeseen emergencies. The point of the responses to the questionnaires is that this incompatibility of objectives is going to be resolved in favor of the economics of load building and not in favor of preserving some convenient valleys to ease the stress on station facilities. As fast as the margins are erased the operators will have to ask for new ones.

Up in the Northwest the increasing demand for domestic house heating may have a most decided effect on the policy of load building. One company in that area indicates likelihood of an effort to limit that type of load over the peak periods.

Geographical Identification

THE CODE LETTERS appearing on each of the 40 load curves are intended merely to identify them with their proper geographical regions without disclosing the identity of the utility concerned. Thus

NE—New England
MA—Middle Atlantic
ENC—East North Central
WNC—West North Central
SA—South Atlantic
ESC—East South Central
WSC—West South Central
MTN—Mountain
PAC—Pacific

The number following each group of letters identifies the position of the particular curve in the series from that region and has no other significance.

Other Questions Can Be Answered

ON THESE eight pages are some 160 load curves, four each for 40 utilities. The four in each case are the summer and winter loads for 1939 and 1946—pre-war and post-war. They constitute the largest collection of such curves ever compiled. They represent the extreme seasonal patterns for nearly half the industry. They are not identified (mostly by request) except as to region.

Why are so many presented along with the deductions from them? Simply so that load analysts, system planners, producers of equipment, appliance manufacturers, commercial departments will have at hand factual information to which to gear their own studies and programs.

One can infer from a study of the curves:—

1. How many companies need plant facilities (coal handling to bus breakers) to ease overhaul problems?
2. How many are most likely to be pressed for transmission interconnection to or from their neighbors?
3. Is a particular load characteristic or situation unique or is it reflected elsewhere?
4. How many electric furnaces or water heaters or electric house heating installations or heat pumps would it take to fill up the seasonal valleys?
5. What are representative system load factors and have they been improving?
6. What are typical values of diversity between systems at time of peak?

Power Generation Trend Upward

Advances in production economy fascinating and startling in recent decades . . . Larger units, higher temperatures and pressures key to extraordinary fuel savings . . . Gas turbines, nuclear research, ahead

HARRY A. WINNE*
Vice-President
In Charge of Engineering Policy
General Electric Co.

SINCE 1900 electric utilities in this country increased their energy production from about 1 billion to over 220 billion kw.-hr., about two-thirds coming from fuel. while average coal consumption dropped from about 6 to 1.25 lb. In the past 25 years from 30 to 40 percent reduction in fuel rates has been attained, with the following savings: Psi. increases, 200 to 1,200, about 10 percent; initial temperature increases, 600 to 950 F., 10 to 14 percent; multi-stage regenerative feed water heating, saved 6 to 8 percent; occassional use of reheat cycle, 2 to 6 percent. Today General Electric Co. is designing and building a 1,050-F., 100,000-kw. steam turbine unit. The highest pressure unit the company has built to date is the 2,300-psi. Twin Branch installation of Indiana & Michigan Electric (American Gas & Electric System), operating at 940 F. with reheat to 900 F., rated at 76,500 kw., and with an economy of 10,000 Btu. per kilowatt-hour. For the Pomeroy station of Ohio Power (American Gas) G. E. is designing a 145,000-kw., 2.000-psi. unit with initial temperature of 1,050 F. and reheat to 1,000 F. This will be cross-compound, with double-flow exhaust, and gives promise of being the highest efficiency steam generating station in the country.

A large part of the gain since World War I may be attributed to the courage and vision of purchasers (the utilities), their willingness to cooperate with turbine builders, and to the boiler manufacturers, who have had their own problems in providing steam at today's high pressures and temperatures. We have arrived at a period of high pressures and temperatures, as proved by the recently adopted A.S.M.E.—A.I.E.E. preferred steam conditions for turbines (units over 20,000 kw., 850 psi., 900 F.; 40,000 and 60,000 kw., alternative 1,250 psi. 950 F.

Mercury Vapor-Steam Cycle

The South Meadow Plant of Hartford Electric Light Co. yielded a plant heat rate of slightly higher than 10,000 Btu. per kw.-hr.—a record which has only recently been broken in steam plants. The average heat consumption in the United States during 1927 and 1928, when this pioneer mercury-steam unit first operated, was over 23,000 Btu. per kw.-hr., and even the best stations at that time had a heat consumption of about 12,500 Btu. per kw-hr. The South Meadow installation was outstandingly successful, its only major maintenance operation having been the retubing of the boiler in 1931:—this despite the fact that its operating temperature was 884 F.

Two other mercury plants are now operating. One of these is at the Kearny Plant of Public Service Electric & Gas Co., New Jersey, where a mercury turbine produces 21,000 kw., and steam for about 30,000 kw. additional, with an over-all heat consumption of about 9,200 Btu. per kw-hr. The other is in our Schenectady Works, producing 10,000 to 12,000 kw. from the mercury turbine.

Of course, there have been troubles with the mercury vapor process. One of these was in getting the mercury to wet the boiler tubes. This has been overcome by a simple chemical treatment. That we have not lost faith in the mercury plant is evidenced by the fact that we are today building, for installation in our Pittsfield Works, a mercury plant having a 7,500-kw. mercury turbine, and capable of supplying from mercury condenser over 120,000 lb. of process steam per hour.

One of the developments of recent years which has enabled us to design for high pressures and temperatures is the large 3,600-rpm. turbine. Generally speaking these units have shell and rotor diameters only one-half those of the older style 1,800-rpm. machines, thus making shell bolting and expansion problems, as well as other design details, considerably easier.

The trend of our business to higher pressures and temperatures parallels the trend from 1,800 to 3,600 rpm. For example, if we consider two successive four year periods (1940 to 1943 and 1944 to 1947 respectively) we notice that in terms of our total utility turbine business, the percentage of kw. produced for 3,600 rpm. has increased from 58 percent to 68 percent. The percentage of kw. on order for 850 psi. and higher pressures has increased from 72 percent to 81 percent. The percentage of kw. for 800 F. and higher has increased from 85 to 97. Almost our entire production—97 percent—is for temperatures of 800 F. and higher. Our total turbine-years of experience with machines at temperatures of 900 deg. and over is now in the neighborhood of 500.

Whither Away Now?

Undoubtedly the steam plant will see its greatest advances in future progress to higher and higher pressures and temperatures, to better cycles, and to better coordination of

* From a recent address by the author before the American Society of Mechanical Engineers at Boston, Mass.

power and process requirements, the beginnings of which we have seen in the last decade. It has not always been easy—in fact, I think I can truthfully say it has always been difficult—in the past to produce machines for pressures and temperatures beyond all previous experience. It will not be easy in the future, but I am sure we shall do it. We are urging our metallurgists to find materials suitable for continuous operation at 1,200 F. and higher; we are asking our designers to produce machines to operate at these temperatures and still have the almost perfect reliability demanded by all utilities.

Variable-Angle Blades

Aerodynamics will yield improved turbine efficiencies—new variable angle stage designs will make their contributions to smoother steam flow and higher efficiencies. Better knowledge and analysis of exhaust blading design will extend the range of capacities for which the various frame sizes can be built. But it seems apparent that any major reduction in fuel consumption in the future must come through improvements or changes in the heat cycle, as the efficiencies of the individual operating units, such as turbines and boilers, are already at a pretty high level.

I believe that we shall see additional mercury installations. It is true that there is not today the difference in heat consumption between the mercury and the steam plant that there was when the first mercury installation was made. As always happens, the target has moved ahead and reduced the gap. But we must not forget the possibility, as we gain experience, of operating mercury above today's 950 deg., and the consequent gain in efficiency which would result.

Developments in the mercury boiler will permit reduced investment in mercury, and the first cost of the whole installation can undoubtedly be decreased considerably. Its already high availability and reliability can unquestionably be improved. Mr. Emmet's dreams may yet materialize.

Gas Turbine Outlook

Of more interest, however, to the power industry is the stationary gas turbine. Several units are now in operation in various parts of the world. Some of these units have modest thermal efficiencies—some 15 to 20 percent; others have efficiencies approaching those of modern steam plants—in the 30 percent and higher range. More remarkable, perhaps, than their efficiencies is the fact that they do produce power. It is well known that for many years no one was able to build a gas turbine which produced *any* net power. Today manufacturers are willing to accept commissions to build power-producing gas turbines in sizes suitable for utility use. Although certainly such an application is considered to be not unreasonable, it is generally conceded that, because of the small size, light weight, simplicity and versatility of this unit, the most attractive applications will be in fields where these virtues are in greatest demand; the airplane, the ship, and the locomotive.

Field of Gas Turbine

The gas turbine will profit greatly in the next decade from the indubitable progress in metallurgy and aerodynamics which lies before us. Perhaps the eventual unit will resemble only slightly our present version; it may be a completely closed cycle—it may be a semi-closed cycle—or, in fact, it may turn out to be the simple open-cycle unit, having modest efficiancy, and no water consumption. Only a prophet can forecast which type will be most in demand by users. Even an engineer, however, can prophesy that this modern internal-combustion turbine will find many and broad fields of usefulness in all technical fields where power is required.

It will gravitate to the most desirable applications—use at the end of long transmission lines, as a low-cost standby unit, in arid areas, to drive locomotives, to propel supersonic aircraft, to drive ocean-going cargo vessels, and perhaps even naval vessels. It will be built in all sorts of combinations, high efficiency units of complex cycle and extensive heating surface for high fuel cost regions, and simple modest-efficiency plants having only turbine, compressor and combustion chamber, for low fuel cost applications. It will be built to run on natural gas, high-grade and low-grade fuel oils, and eventually, we believe, on producer gas or pulverized coal.

And now as we look into the future we encounter a new, but very much talked of, possible source of power. I refer of course to nuclear, or as it is more generally termed, atomic energy. Whether, and when, this will become an important factor in power generation, only time can tell.

Nuclear Energy Prospects

Atomic energy is essentially a source of heat. We can foresee no way of converting it directly into usable electrical power in significant quantities. So, we may look for the atomic power plant of the future to consist of the nuclear reactor, or so-called "pile," in which heat will be generated by fission, and transferred through suitable means, probably with an intermediate transfer, to some more or less conventional power generating unit, such as a steam turbine, a gas turbine, or a unit utilizing the vapor of mercury or some other substance. As many of you know, such a plant is already being engineered at Clinton Laboratories, Oak Ridge, Tenn. But this is simply a pilot plant, a developmental installation, really practically a laboratory experiment. Many, many technical problems remain to be solved, but I feel sure they can be, and will be solved, *in the course of time.*

One has only to look at the years it has taken to bring the mercury plant to its present state of development, or the gas turbine, to realize that a long road of development lies ahead.

And beyond the technical questions there are those of economics, and here the answer is still less certain. There are still far too many unknowns in the economic equation.

Personally, I believe that in the course of time, production of electrical power from atomic energy will become an important factor. But in my estimation that time is considerably more than ten years away—quite possibly two or three decades. And the introduction of atomic power into our economy will, I believe, be very gradual and not at all up-setting to our present utility industry. I look for atomic energy to supplement and complement our present power sources—not to replace them.

Surely all the possibilities present great challenges to the engineers responsible for building and using power-generating equipment.

Brief Absorption Test Index of Dielectric Condition

ROLAND BLACKWAY
Insulation Test Engineer
Maintenance Section
Philadelphia Electric Co.

Increment in megohms between 30 and 60 seconds found more indicative of state of insulation in power transformers than prolonged tests or inferences based on slope ratios

DIELECTRIC absorption effect can be used in the study of insulation condition of power transformers. It is believed that the increment increase of resistance over the period 30 to 60 sec. gives more information than other periods. The one-minute dielectric absorption test, using a motor-driven insulation testing set, is economical, indicative and efficient.

Nature of "Absorption"

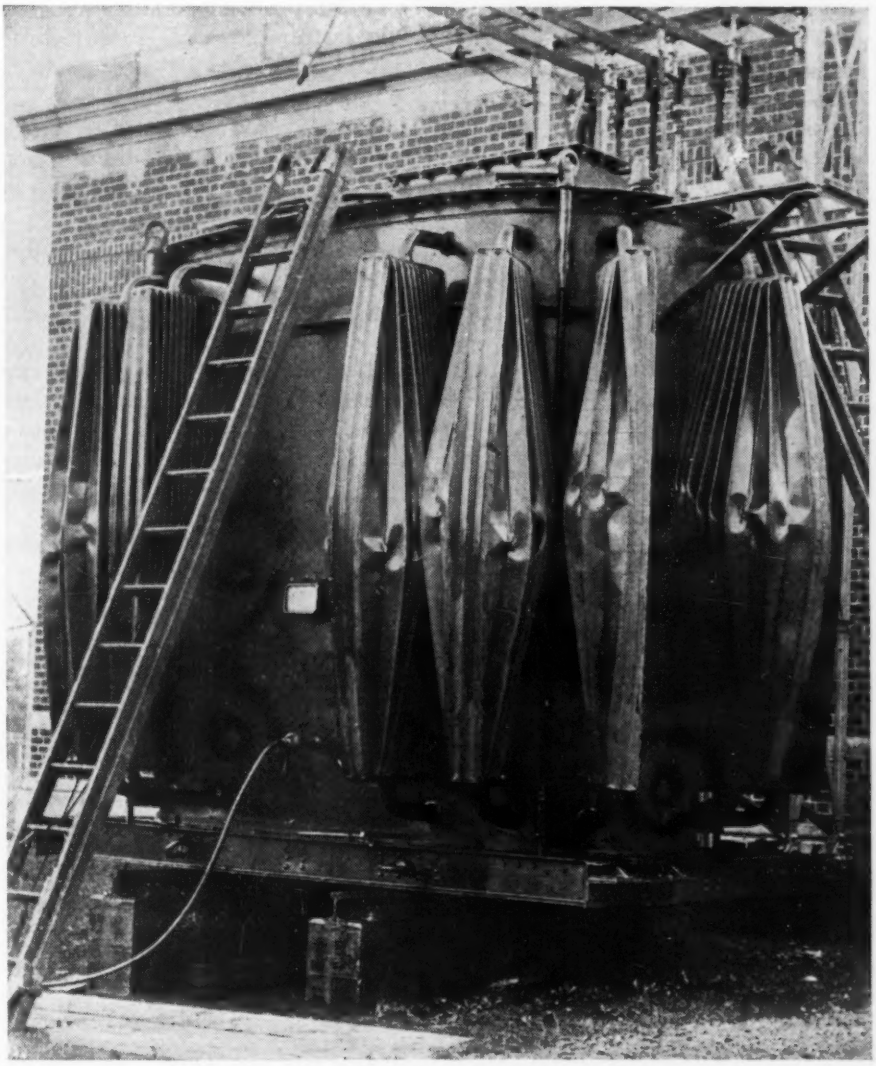
When a constant d. c. voltage is applied to a dielectric circuit there are three major components of the total current. One is the resistance component, a true leakage current which is practically a fixed value. A second component is known as the charging current, with a comparatively high value at the start of the charge of the capacitance, but quickly decreasing to zero in a time period of a few seconds —or in the case of a small capacitance, in micro-seconds. The third component is the dielectric absorption effect. This phenomenon is assumed to be due to the lack of homogeneity in the material forming the dielectric circuit. Another term that has been used is the polarization effect.

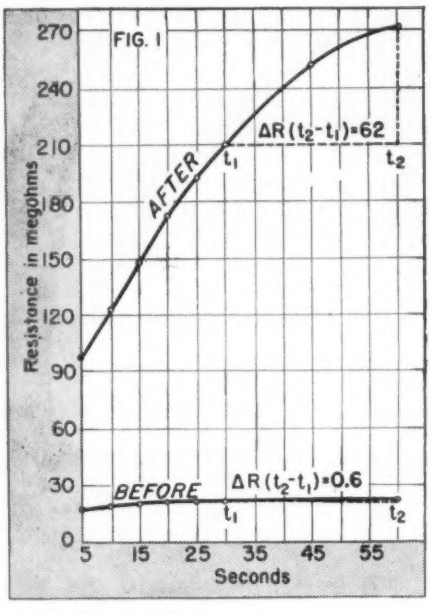
500 Tests Made

Increment resistance rise between 30 and 60 sec. from zero time supplies all the necessary dielectric absorption information on the insulation. Running the test for 10, 15 or 30 min., gives no additional information, provided the proper instrument is used and supplemented by a careful analysis of the readings and study of the apparatus under the one-minute test.

Since 1941 the writer has been making dielectric absorption tests on power transformers. These tests were made mainly as research tests with the idea of acquiring additional information to supplement the standard periodic power factor tests on power transformer insulation.

RESULTS of a coil failure in a 4,000-kva. 3 phase, 33/4-kv. power transformer (No. 4)





ONE-MINUTE dielectric absorption test before and after reconditioning of transformer (No. 1)

Approximately 500 dielectric absorption tests have been made on transformers, also on synchronous condenser windings and cables. These tests included transformers with a voltage range from 2.3 kv. to 220 kv. and a capacity range from 100 kva. to 43,333 kva. per unit. The tests were made on single-phase units, three-phase units, and a special group of single-phase three-winding transformers. The instrument used for these tests was a motor-driven insulation testing set, 1,000 volts, with a range of 0.04 to 5,000 megohms. This is a sturdy, reliable instrument for field use.

Second Half-Minute

After considerable study of preliminary tests, increment resistance value from ½ to 1 min. was selected as the critical index to the insulation condition. Apparently this is a wide departure from previous viewpoints on dielectric absorption research, as many researchers have used a 10- 15- or even a 30-min. "slope" (ratio for a given time period), whereas in this method the index is not a ratio but a definite increment increase for a given period.

Other researchers considered the critical index as the total time expended for the maximum absorption. Some transformers may be tested for a period of 30 min. without reading maximum absorption, in others the maximum absorption is reached within 2 or 3 min. depending upon the condition of the windings or the condition of the oil, or a combination of the two.

Using the ½- to 1-min. index gives a record valuation for all transformers. It also has the advantage that it provides this information in the minimum of working time.

Limits of Acceptability

Following limits have been adopted as a delineation of acceptable and rejectable insulation condition using the increment increase in resistance from ½- to 1-min. time period:

Acceptable

Single-phase, two-winding transformer = 20 megohms (Min. value)

Three-phase, two-winding transformer = 10 megohms (Min. value)

The "Megger" readings are calculated to a base of 40 C. with reference to transformer top oil temperature. For a top oil temperature of 20 C., the instrument reading as recorded would be divided by 4 to obtain the 40 C. base value.

In the special group of single-phase, three-winding transformers, the test voltage was applied to each of the transformer windings, respectively, with the other two windings grounded.

Case Histories

The case history of a few transformers of the several hundred units tested will show the value of using the increment of resistance increase

TABLE I

Transformer Data

Number	Phase	Kv.	Kva.	Date of Mfg.	Type
1	3	33/4	5000	1930	Conservator
2	3	33/4	5000	1930	Conservator
3	3	33/4	5000	1930	Conservator
4 (N1)	3	33/4	4000	1928	Conservator
5 (N2)	3	33/4	5000	1931	Gas-filled
6	3	33/4	5000	1931	Gas-filled
7	1	33/13	2000	1918	Open Breathing
8	1	33/13	2000	1918	Open Breathing
9	1	66/13	20000	1923	Gas-filled
10	3	33/4	5000	1928	Conservator

(N1) Rejected by power factor test 1937. Failed 1942.
(N2) Rejected by power factor test 1939. Relayed upon internal arcing 1942.

TABLE II

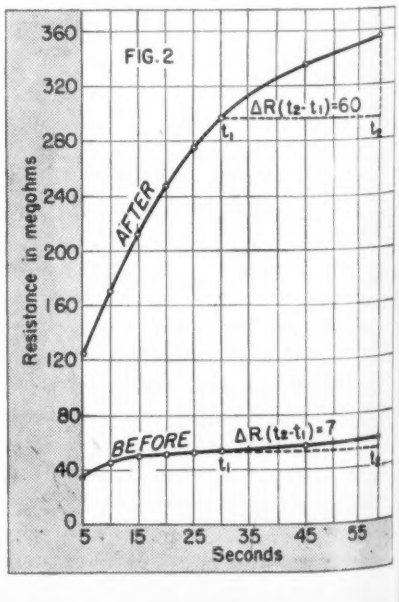
Test Data
Transformer Insulation

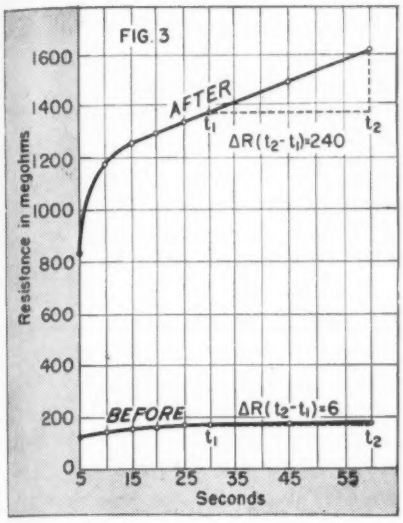
Transformer No.	Test	Connection	Date	ΔR ($t_2 - t_1$) Megohms
1	1	H/LG	8/28/41	0.6
1	b	L/HG	8/28/41	0.6
1	c	HL/G	8/28/41	0.6
1	d	H/LG	12/ 3/43	0.5
1	e	H/LG	8/15/44	0.5
1	f	L/HG	8/15/44	0.5
1	g	HL/G	8/15/44	0.4
1 (N1)	h	H/LG	11/21/45	62.0
1 (N1)	i	L/HG	11/21/45	84.0
4	a	H/LG	5/22/41	7.0
4	b	L/HG	5/22/41	3.6
4	c	HL/G	5/22/41	8.4
4 (N1)	d	H/LG	7/31/44	60.0
4 (N1)	e	L/HG	7/31/44	30.0
4 (N1)	f	HL/G	7/31/44	45.0
9	a	H/LG	5/13/43	240.0
9 (N2)	b	H/LG	7/ 4/44	6.0
9	c	H/LG	10/ 1/44	20.0
9	d	L/HG	10/ 1/44	9.5
9	e	H/LG	12/10/44	14.0
9	f	H/LG	3/ 5/45	27.0
9	g	L/HG	3/ 5/45	13.5
9	h	H/LG	12/16/45	31.0
9	i	L/HG	12/16/45	31.0
10	a	H/LG	1/31/44	7.0
10	b	L/HG	1/31/44	3.6
10	c	HL/G	1/31/44	6.4
10 (N3)	d	H/LG	8/11/44	7.0
10 (N3)	e	L/HG	8/11/44	6.0
10 (N3)	f	HL/G	8/11/44	50.0

(N1) = Test after reconditioned.
(N2) = Test after water leak in cooling coil
(N3) = Test after oil replaced with new oil

Δ R, for the period ½ to 1 min. ($t_2 - t_1$) as indicating the insulation condition of the apparatus under test. The term "ABS" is the total

ONE-MINUTE dielectric absorption test before and after reconditioning of transformer (No. 4)





ONE-MINUTE dielectric absorption test before and after detecting leak in water cooling coil of transformer (No. 9)

time in minutes for the maximum absorption effect.

Transformer No. 9 was in excellent condition, from all test results in 1943. On July 2, 1944, a leak in the water-cooling coil was discovered due to high oil level in the gage-glass. This defective cooling coil, one of a total of six coils, was shut off. Approximately 84 gal. of clear water and 135 additional gallons of oil and water mixture were drawn off from the bottom of the transformer in question.

In Table 2, observe the drop of $\Delta R(t_2 - t_1)$ from 240 to 6 megohms two days after the water leak was noticed. Prior to the (9c) test on October 1, 1944, the oil was filtered several times. Since the (9c) test, the oil has been filtered occasionally and during the last nine months of 1945 a circulator was temporarily installed to remove the moisture from the nitrogen, as this bank was needed and there was no available spare unit for a regulation dry-out.

Cooling Coil Leaks

From this case, it is apparent that where a cooling coil leak develops from a minute origin, it may be readily detected by the 1-min. dielectric absorption test, if the test is made at frequent intervals, long before being detected by other tests, including an oil sample test.

Tests (9h) and (9i) indicate that the insulation condition of the high- and low-voltage windings has equalized. Although the insulation condition has been improved since the water leak was observed, it is far below the original value with a $\Delta R(t_2 - t_1)$ of 240 megohms.

With reference to Transformer No. 10, the writer recommended reconditioning of this unit, including a regular dry-out of the windings. Seven months later, this transformer was drained, the windings flushed, and filled with new oil, but no dry-out run was made. The new oil made no appreciable change in the High/Low + Grd., or in the Low/High + Grd. reading, but was reflected in the High + Low/Grd. reading. This transformer is still on the rejected list and is now installed in a location on the system as an emergency transformer bank.

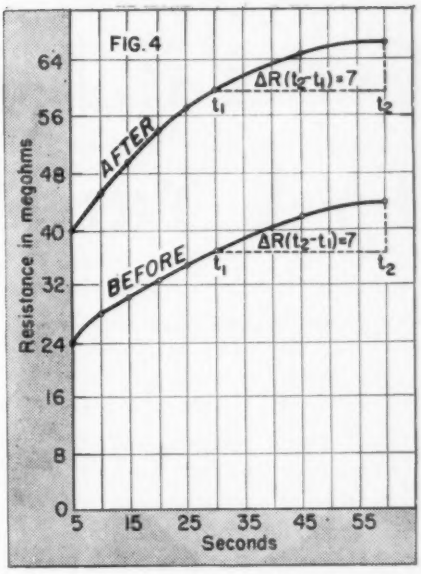
The total time of the dielectric absorption effect "ABS" for each of the transformers of Table 3 is indicated to show how inconsistent this index is with reference to the insulation condition.

Slope vs. Increment

Some researchers are using the 10/1-min. resistance slope factor as the index of insulation condition. A study of Table 3 will indicate how inadequate this slope factor is for transformer insulation. For example, the slope factor of No. 4 transformer, prior to its failure, was greater than No. 2 and No. 7 transformers after they were reconditioned.

With reference to dielectric absorption tests on transformers and other windings, the increment increase of resistance ΔR, over the period 30 to 60 sec. $(t_2 - t_1)$, is not a compromise or a substitute for a longer period, or for the total period of absorption, nor for a ratio or slope method. This period is the normal period of excess change in the dielectric circuit, in fact this period represents the *greatest change* of any component time element of the dielectric absorption test, after the first 30 sec. The manufacturer of the "Megger" advises that there is no appreciable effect of the protective ballast resistance in the instrument circuit after the first 30 sec.

When this increment resistance increase does not reach the proper prescribed limits, there is conclusive evidence that the insulation (dielectric) in the test circuit is not in satisfactory condition.



ONE-MINUTE dielectric absorption test before and after oil in transformer (No. 10) was replaced with new oil but without drying out windings.

TABLE III

Transformer Test Data Before and After Reconditioning, H/LG

Transformer No.	Before Reconditioning			After Reconditioning		
	ΔR ($t_2 - t_1$) Megohms	ABS Min.	10/1 Minute Slope	ΔR ($t_2 - t_1$) Megohms	ABS Min.	10/1 Minute Slope
1	0.5	4.0	1.05	62.0	25.0	1.54
2	1.1	2 0	1.06	44.0	6.0	1.27
3	1.9	12.0	1.31	90.0	+30.0	1.38
4	7.0	20.0	1.33	60.0	20.0	1.71
5x	0.7	8.0	1.07	....	....	....
6x	....	....	....	50.0	6.0	1.35
7	19.5	15.0	1.22	52.0	6.0	1.27
8	6.0	6.0	1.26	69.0	+8.0	1.48

(x) No. 5 and No. 6 transformers of same type, capacity and age.

Federal Audit Whittles TVA Yardstick

LIKE most human endeavors, the Tennessee Valley Authority is neither as perfect nor as base as it has been alleged to be almost constantly since it was begun 14 years ago.

Its management is entitled to the "highest commendation" for effectiveness and for doing its job. But its accounting needs revision, and it should bear more of the federal burden. In 1945, TVA probably operated at a profit, but it never has furnished—and without considerable accounting changes never will—the "yardstick" it was supposed to provide for the measurement of the electric power industry.

These are conclusions of an audit report on TVA released recently by the General Accounting Office Corporation Audit Division, an agency established to furnish Congress with complete and disinterested reports on the numerous government corporations. This report:

1. Exposes the fallacious "yardstick" theory.
2. Recommends substantial change in TVA's accounting and financing law.
3. Denotes items not now charged as power costs and recommends that some be so charged.
4. Recommends repayment by TVA of all capital expenses chargeable to power, with interest at going rates.
5. Indicates the probability that TVA's power revenues in fiscal 1945, the first year it returned a "profit" to the U. S. Treasury, were "more than adequate to cover all power costs".
6. Finds TVA "comparing quite favorably . . . with well-managed private corporations" in its use of accounting in management.
7. Praises TVA's management as "entitled to the highest commendation for the effectiveness with which the authority functions and for its accomplishments in carrying out the functions of the TVA Act."

The report, although seemingly inconclusive, is noteworthy. Heretofore, little criticism of TVA has appeared in federal documents. While not an indictment, this report does not give TVA unreserved praise, as has been federal practice. It suggests specific amendments of a nature hitherto scorned by TVA. It notes, with or without recommending change in, practices which have always drawn the fire of business—failure to pay federal income taxes, handling of cost allocations on multiple-purpose facilities, failure to pay interest on all power investment, and others. It also asserts that, until such practices be corrected, no one can ever demonstrate conclusively that TVA's power program operates at a profit. The very fact that the report mentions such items, which hitherto have been ignored by TVA's proponents, makes this report unusual.

Rejection of the "yardstick" is

Why It's Important

FOR 14 YEARS, the Tennessee Valley Authority has epitomized the revolution in the United States' power supply which began in 1933 and has been pressed ever since. Those who favor public ownership of electric power—plus a large group whose interests in power are more or less incidental to their main desire for federalized economic planning, regional development or merely pork barrel spending—have been lyrical in TVA's praise. Those who oppose public power ownership, plus a smaller group which is against federal expansion, have been equally adamant and relentless in attacking TVA.

Unfortunately, there has been little if any disinterested, dispassionate, major, critical analysis of the program. Many have tried, perhaps, to assay it objectively, but in almost every case, it has been possible to track their motivation back to a source which was distinctly interested in creating either an attitude of approbation or one of condemnation.

It is because of this background that the recent audit-report prepared by the Corporation Audits Division of the government's General Accounting Office is of such significance. It was prepared by a group which had nothing to gain or lose by its treatment of the subject. It has real official status, having been prepared by a government agency. While it may never be considered of impeccable motivation by the extremists of either camp, it has a better background, from the point of view of disinterestedness, than almost any other critical estimate of TVA which has been made public.

unmistakable, though not explicit. It notes that "the cost allocated to power, thus far the main revenue-producing program, is less than the estimated cost of a hypothetical single-use investment for that purpose . . . (This) basis . . . is also used in allocating operating costs for maintenance and depreciation of the multiple-use facilities. Therefore, the effect . . . is to reduce operating costs . . . below what would have been borne on the basis of single-use operations. For this and other reasons, the cost of power operations may not be compared with private power corporations' power operations."

On the basis that the "yardstick" theory was one of the foremost arguments advanced in selling enactment of the TVA program, this conclusion, from such a source, is a vindication of the assertion which opponents of TVA have long made—that the authority used only a "30-in. yardstick".

The report asserted the necessity to relieve TVA of numerous unnecessary and wasteful practices now required by law. Equally important was the necessity to forbid TVA certain assumed prerogatives of finance, which the Division felt should be under Congressional control.

Section 26 Repealer

To give TVA the discretion it needs, the audit-report recommends that Section 26 of the TVA Act be repealed. It substitutes for Section 26 an eleven-point plan which would free TVA of unbusinesslike restrictions and subject its financing more completely to Congressional control.

Recommending repeal of Section 26 is an unheard-of position for a government agency to take regarding TVA. It involves an interpretation of the section asserted successfully by TVA's directors. The section provides that annual receipts from power operations be paid into the Treasury. It exempts such proceeds as "in the opinion of the Board" are required to operate its power and fertilizer businesses. Also exempted is a continuing $1,000,000 emergency fund. TVA made its first payment under Section 26—$12,597,744—to the Treasury in December, 1945.

The audit-report questions whether Section 26 permits the use of power

Independent report praises TVA management's accomplishments but suggests accounting changes to show power costs more completely . . . Payment of full interest on entire power investment recommended . . . Financing changes suggested

revenues "for construction of facilities for generating, transmitting, and distributing electric energy." Conceding that Section 12 "expressly authorizes" the use of power revenues for transmission lines alone, the report adds:

"TVA directors have interpreted Section 26 to authorize the use of power and other revenues for still other capital purposes (than transmission lines); they hold that Section 26 authorizes expenditure from power and other revenues for the construction of generating facilities and any other facilities required for the electric power business, excluding only expenditures for multiple purposes. . ."

TVA directors have made no secret of this interpretation, but rather have asserted it several times to Congress without being upset. Regardless of this implied approval, the audit-report continues, the interpretation "has operated to limit Congressional control . . . of the capital requirements . . . and to reduce . . . appropriations which otherwise would be required." It questions "the necessity or desirability of Congress giving up control of all requirements for capital funds. . ."

Failure to Repay

Another result of the interpretation, the audit-report finds, is a ". . . failure to provide any positive basis for repayment . . . of its investment in power facilities. We question the wisdom of not requiring a specific basis for annual determination (one . . . susceptible of independent audit verification) of the amounts to be repaid . . . and we recommend the use of more positive . . . control by Congress of the capital funds to be devoted to construction. . ." The report added that through June 30, 1945, TVA had used about $100,000,000 of power revenues for construction of additional facilities, largely power, "including approximately $18,000,000 during fiscal 1945." Of the $18,000,000, about $10,000,000 went for transmission lines expressly authorized under Section 12, the remainder to generating and other facilities not directly mentioned in either Section 12 or 26.

11-Point Program

The 11-point program substituted for Section 26 recommends:

1. TVA's over-all capital requirements be determined and written into law. This would establish a limit, not necessarily permanent, on the agency's capital investment and define its source, i.e., bonds, appropriations, revenues, or capital subscriptions.

2. TVA's future capital requirements from the U. S. Treasury should be made only by Congressional appropriation of funds for "subscriptions to capital." This would finance future extensions of TVA's power or other activities.

3. TVA should be permitted to borrow only from the Treasury, and there only temporarily. Limits would be established by Congress. Interest would be at current federal interest costs, rather than below cost.

4. TVA should determine and show separately on its books all capital derived from appropriated funds and invested in power facilities or otherwise used in power activity. This would show investment in power and is desirable in view of the TVA Act's intention that power activities be self-liquidating.

5. Law should provide a definite plan for repayment of appropriated funds invested in or otherwise used for power. Interest should be paid on this capital.

6. Net power income should be carried to an earned surplus account. As such it would become a

(*Continued on page* 142)

Outdoor Primary Metering With Lightning Protection

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SHOP-ASSEMBLED, instrument transformer enclosures for pole top mounting have been developed by the Pennsylvania Electric Co. for metering 2.4 kv. to 12 kv. to obtain uniformity, sufficient lightning protection and a more desirable appearance. A new development was necessary since none of the existing installation methods could be adapted to or serve as a suitable system standard following the merger of several service companies into a single operating unit. To obtain the maximum lightning protection, an instrument transformer unit was designed for each distribution voltage. The units also insure greater safety, transformer shielding, improved appearances and provide coordination between equipment insulation and that of the line.

Metal Enclosed

A unit consists of a metal enclosure, supplied by the utility, to house indoor instrument transformers. Lightning protection is made an integral part of the unit by having arresters for each phase wire installed on supports welded to the enclosure. Current bushings of the twin-conductor type and a potential bushing, made watertight, enter the top of the enclosure adjacent to the arresters. Terminals on the bushings permit connections to the arresters and line with comparatively short leads. The leads to the arresters are no more than 8 in. in length and those to the line between 18 in. and 36 in.

Assembled in Shop

Components are completely assembled and wired in the meter shop and installed as a unit. Transformers are supported within and on the back of the enclosure by mounting bars. Potential transformers having insulators extending from the top of their cases are supported on a bridge elevated above the bottom. Supports and means of attachment permit changing individual transformers with a minimum of time and effort without resort to special tools or devices.

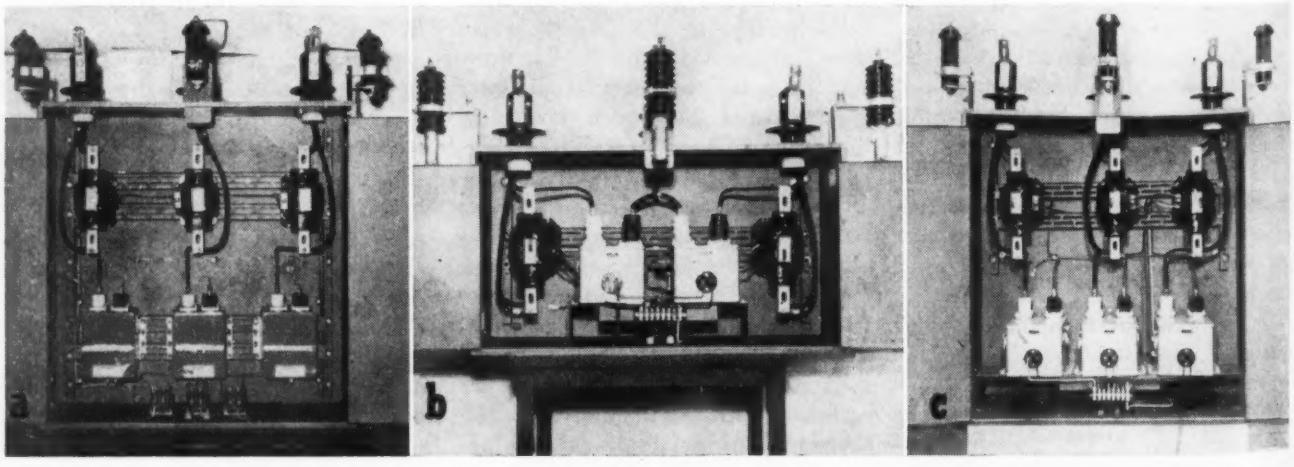
Assembly of a unit is usually completed in one man-day; under normal conditions, it can be installed in two hours, exclusive of travelling time, by a line crew of three and one meterman. This short outdoor period of time is distinctly advantageous during the winter or inclement weather and had considerable influence in the selection of the method that was adopted.

Installation Details

The line crew installs (1) strain insulators in each line conductor to be connected to a current transformer, (2) fused line cut-outs when required, (3) one crossarm to support the enclosure, (4) a common ground conductor and (5) makes line connections. Color-coded control cable, connected to a terminal block within the enclosure, is extended through a bushed knockout to the meter location and connected to a test switch.

The meter itself, in a separate en-

CABINET ASSEMBLY of outdoor primary metering installations. Rain hoods removed . . . (a) Three-phase, 4-wire, 4,160/2,400-volts . . . (b) Three-phase, 3-wire, 6,900-volts . . . (c) Three-phase, 4-wire, 8,300/4,800-volts



Indoor-type instrument-transformers mounted in shop in standardized cabinets for voltages up to 12,000 volts . . . Quick installation, bettered safety, easier periodic inspection, good lightning performance have been achieved

closure, is wired to its test switch in the meter shop and installed simultaneously with the transformers. The meter is located within a building on the customer's premises whenever possible but in the absence of a building or a suitable location the installation is made at the bottom of the pole about 5 ft. above the ground line.

Appropriate Dimensions

The enclosure for three-phase, three-wire at 2,400 volts is 42 in. wide, 24 in. high and 12 in. deep with two current and one potential bushings rated at 5 kv. and three arresters of the 3-kv. class. Mounting bars support both the current and potential transformers.

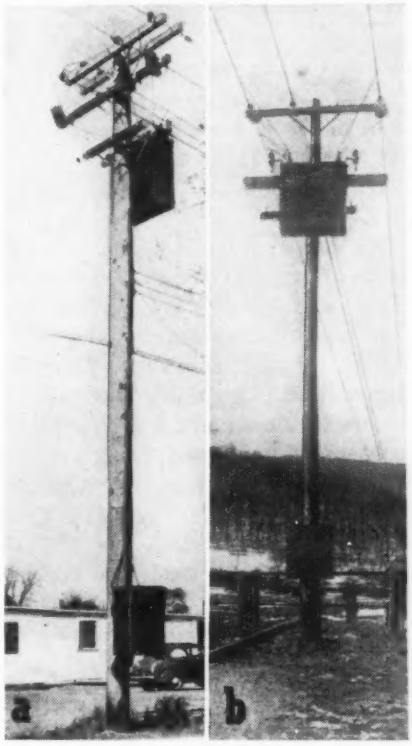
For three-phase, three-wire at 7,200 volts, the enclosure is 44 in. wide, 24 in. high and 14 in. deep with two current and one potential bushings rated at 8.7 kv. and arresters of the 6-kv. class. Mounting bars support the current transformers while a bridge supports the potential transformers.

At 4,160/2,400 volts, three-phase, four-wire, the enclosure is 42 in. wide, 42 in. high and 14 in. deep with three 5-kv. current bushings and arresters of the 6-kv. class. Ground studs are provided for connection to each potential transformer and the neutral conductor. Two sets of mounting bars are provided and support the current and potential transformers in separate rows.

The enclosure for three-phase, four-wire at 8,300/4,800 volts is 42 in. wide, 42 in. high and 16 in. deep with three 8.7-kv. current bushings and arresters of the 6-kv. class. A bridge supports the potential transformers and mounting bars the current transformers.

Enclosures for three-phase at 12,000 volts wye and delta have been designed but none have yet been installed.

The adaptation of outdoor transformers to this service, while practicable, was not considered economical, as a very large percentage of the total in service are of the indoor type. Outdoor transformers would require a duplication of stock for some years and materially increase its value. The same labor for a longer period of time would be required to install outdoor transformers and equal lightning protection that would be difficult to obtain.



INSTALLATIONS of the standardized instrument transformer assemblies . . . (a) A 4,160/2,400-volt unit with line cutouts. The second arm is unnecessary for supporting the 400-lb. weight of the unit . . . (b) A 8,300/4,800-volt installation

Costs Generally Favorable

The cost of these standard units installed for three-phase, three-wire service at 2,400 volts is slightly more than the equivalent installation of outdoor transformers. This margin decreases as the voltage increases and the comparative costs reverse at 7,200 volts. The four-wire, three-phase units installed cost less than the equivalent installation of outdoor transformers. It is practicable to modernize existing metal enclosures to this standard with slight modifications for a nominal cost which also acts to favor the use of indoor transformers.

Installations of these units, with all primary conductors above the enclosure, reduce the lineman's hazards and periodic inspections of the equipment may be made with a maximum of safety. Requiring fewer items of pole line materials, costs are not only reduced but the general appearance of the pole top is very much improved.

Lightning Protection

The maximum protection against lightning damage is obtained by having the arresters installed as near the equipment as practicable. Further protection is provided by a small air gap between line and load terminals within each current bushing which tends to dissipate line surges. Arresters, transformer cases and secondaries are grounded through a common conductor connected to one or more rods to obtain a ground resistance of about 5 ohms. Prior to installation, these units were subjected to surge tests of ample magnitude to demonstrate that sufficient protection is provided.

The trend toward outdoor installations of instrument transformers has been increasing for several years and is justified in simplifying the customer's service equipment and the utility's facilities. The units appear to be the best answer to that problem. The number installed falls short of that contemplated, due to shortages of materials and equipment, but those already in service have proven their value. Several units have been installed at locations where lightning is a frequent source of trouble and storms of unusual severity have done no damage. It is fully expected that the number of transformers destroyed in service will be reduced at least 80 percent and no doubt more when the modernization program becomes fully operative.

House Heating Load Characteristics

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TESTS to determine characteristics of electric house heating load, completed or now under way in the Pacific Northwest, have developed sufficient information on demand and diversity of this type of load, it is felt, to justify a study of certain specific Code requirements that tend to impose excessive wiring costs on the home owner. Every branch of the electrical industry is vitally interested in the development of space heating load and it is logical that wide public acceptance of electric house heating should cause the utility, the manufacturer, the electrical contractor and the wiring inspector to study all problems in connection with its development in order that intelligent decisions may be made.

The present Code does not recognize any diversity in electric space heating, whereas tests have shown that there is a substantial diversity. This is especially true of the prevailing type of installation comprising unit heaters with individual thermostatic control. Even with central furnaces, which are becoming popular, there is some diversity. Certainly the industry does not want inferior wiring or unsafe wiring, but it is felt that electrical inspectors should accept factual data on demand and diversity as rapidly as it is developed and should modify requirements in the light of findings to the end that consumers' wiring costs can be gradually reduced, thereby minimizing this point of sales resistance. Contractors certainly are not interested in selling a limited number of expensive wiring jobs, but do want large numbers of reasonably priced installations. The wiring inspectors gain on the same basis along with those interested in power sales and revenue.

Wiring

Two hundred and thirty-volt service should be used on all heating equipment over 1,500 watts. Since central furnaces are usually controlled by a single thermostat, a circuit capable of carrying the entire connected load is required. However, on those central furnaces equipped with modulating or step controller, there has never been experienced a 30-min. demand greater than 67 percent of the all-service connected load. A substantial diversity has been noted between the furnace, range, water heater and other appliances because the maximum heating load occurs during the early morning hours when other electrical uses are at a minimum. The individual room-type unit heater introduces an entirely new factor, that of diversity between units themselves within a single house. The following data and discussion are based on unit heater equipped homes.

Longview Tests

Tests made on a number of electrically heated homes in Longview, Wash., (ELECTRICAL WORLD, Nov. 24, 1945) indicated a maximum individual *heating* demand of 10 kw. for a house having a connected *heating* load of 15 kw. Other houses ranged lower, although some had connected *heating* loads as high as 20 kw. Data for each of these seven houses are shown in Fig. 1. These data give information on the load imposed on metering facilities, service entrance conductors and main entrance switches by heating equipment.

Diversified heating demand on this group of seven homes was approximately 55 kw., an average of 7.85 kw. per house, for the minimum temperature day, December 15, 1944. Outside temperature was 15 deg. F., heating design basis for the houses. Theoretically, the entire connected heating load of 120.5 kw. should have occurred, yet the peak all-service demand was only 69 kw., of which 14 kw. is estimated as non-heating load.

The Longview houses are equipped with 1¼ in. service entrance conduit, with two No. 2 and one No. 4 conductors, and are metered with either 15- or 50-amp. socket type meters. A 100-amp. entrance switch was used with one panel for range, water heater, lighting and appliances. A separate panel with four or six 20-amp., 230-volt circuits was installed for the heating load. A maximum load of 4,000 watts was placed on each circuit by combining two or more heaters. Total connected load for heating, appliances and lighting varies from 30 to 35 kw. Wiring costs, including a proportionate share of service entrance facilities, averaged $10 per heater outlet at 1941 price levels.

Seattle Tests

Metering tests were established on a group of 33 electrically heated homes in Seattle early in January, 1946. Data for the entire group are given in Figs. 2 and 3. Connected heating load was 531.4 kw., or an average of 16.1 kw. per house. Connected miscellaneous load was 495 kw., an average of 15 kw. each. Total load was 1,026.4 kw., or an average of 31.1 kw. per house. Peak measured demand was 288 kw., or 8.73 kw. per house on a 21.5-degree day (Fig. 3) with minimum temperature of 39 deg. F. and maximum of 48. Energy consumption was 3,308 kw.-hr., average demand 137 kw., load factor 47.8 percent, and demand factor 28.1 percent. Fig. 2 is presented to show that for a 27.5-degree day with minimum temperature of 32 deg., a lower peak and greater diversity were shown.

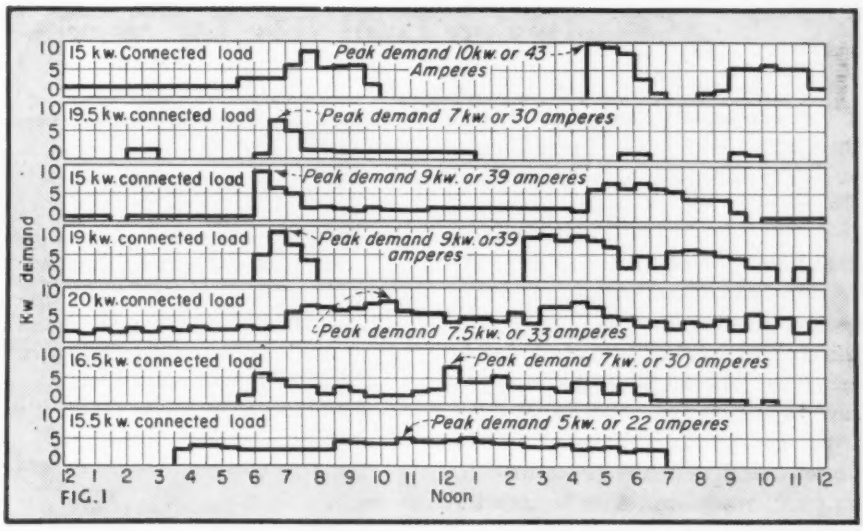
A number of houses were individually tested over a period of several months with the result that the highest demand factor recorded for total connected load in any house was

As They Affect Wiring Costs

46.4 percent. Most of them ranged between 30 and 40 percent.

These data are cited to show that the demand factor for this group of 33 houses as a whole was only 28.1 percent and highest for any one house was only 46.4 percent. Thus is supported the contention that some diversity should be taken into consideration in determining wiring requirements in an electrically heated home.

The Seattle houses were equipped with a main service entrance of 2-in. conduit, two No. 1/0 and No. 1 conductors and are metered through current transformers. A 200-amp. entrance switch was used with one panel for range, water heater, lighting and appliance circuits and an additional panel for the heating circuits. Only one heater was connected on each circuit. Total connected load varies from 30 to 33 kw. Wiring costs, including a proportionate share of service entrance facilities, averaged about $20 per heater outlet at 1945 price levels.


15 kw. Connected load
Peak demand 10kw. or 43 Amperes
19.5 kw. connected load
Peak demand 7 kw. or 30 amperes
15 kw. connected load
Peak demand 9 kw. or 39 amperes
19 kw. connected load
Peak demand 9kw. or 39 amperes
20 kw. connected load
Peak demand 7.5 kw. or 33 amperes
16.5 kw. connected load
Peak demand 7 kw. or 30 amperes
15.5 kw. connected load
Peak demand 5 kw. or 22 amperes
Kw demand
12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12
Noon
FIG. 1

INDIVIDUAL house 30-min. demand curves for space heating only for seven homes in Longview, Wash. Data are for March 7, 1945.

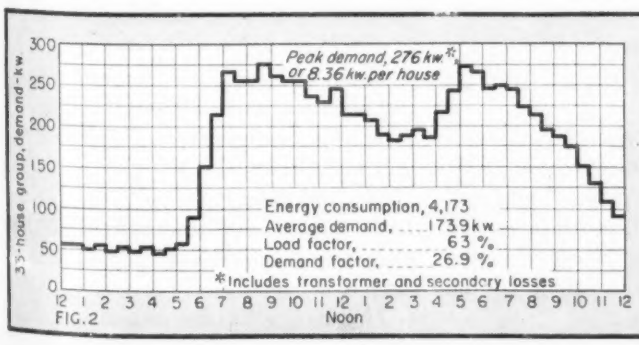
Portland Tests

The Portland General Electric Co. has been conducting metering tests for the past year on many individual homes, some equipped with central furnaces and others with unit heaters (ELECTRICAL WORLD, March 16, 1946, page 82, and September 14, 1946, page 84). The highest all-service demand from any furnace equipped home was 23.6 kw. on May 5, 1946, when minimum outside temperature was 45 deg. F. Maximum *heating* demand was 19.6 kw. on July 16. This particular house has a total connected load of 35 kw. of which 20 kw. is heating. The all-service demand factor is 67 percent, *heating* demand factor is 98 percent. All-service demand factors on other houses with furnace ranged from 36 to 64 percent. On the coldest day, December 14, 1945, when minimum outside temperature was 26 deg. F., the highest all-service demand was 13 kw. of which 10.8 kw. was heating. These demands were recorded from a house that has a total connected load of 31 kw. of which 16 kw. is heating.

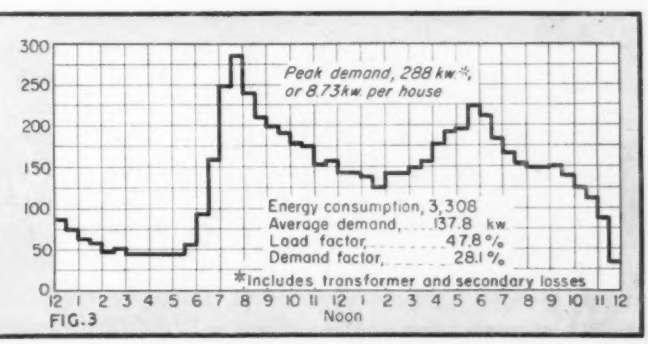
The highest all-service demand for any unit heater equipped house was 22.4 kw. on December 4, 1945, when minimum outside temperature was 45 deg. F. Maximum *heating* demand was 17 kw., occurring on the same day. This house has a total connected load of 47 kw. of which 32 kw. is heating. The all-service demand factor is 17 percent, heating demand factor is 53 percent. All-service demand factors on other houses with unit heaters ranged from 27 percent to 55 percent. On the coldest day (date and temperature

(*Continued on page 174*)

ALL-SERVICE demand and energy consumption for group of 33 electrically heated homes in Seattle. Data are for Jan. 30, 1946

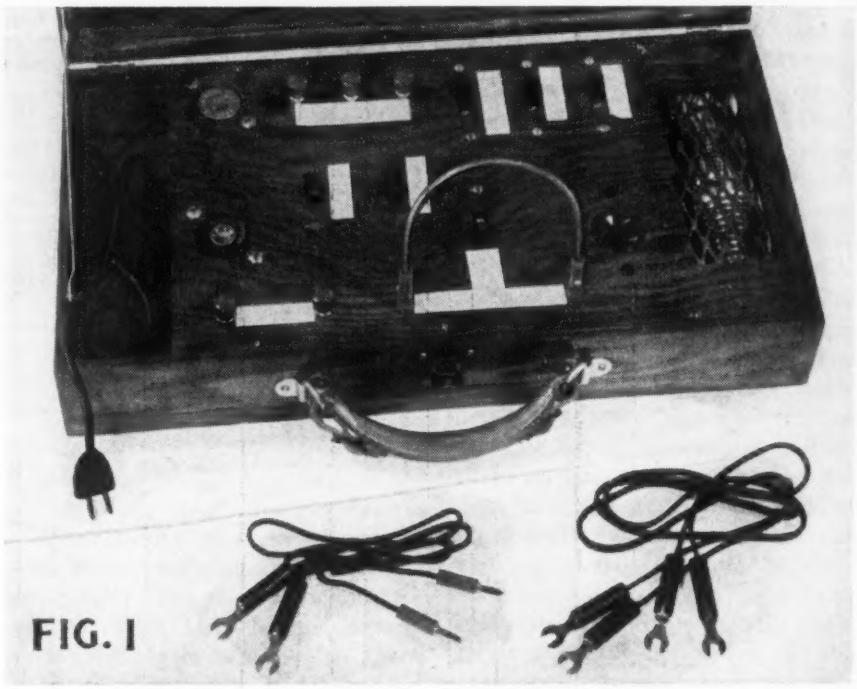

Peak demand, 276 kw.*, or 8.36 kw. per house
33-house group, demand-kw
Energy consumption, 4,173
Average demand, 173.9 kw
Load factor, 63 %
Demand factor, 26.9 %
*Includes transformer and secondary losses
12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12
Noon
FIG. 2

ALL-SERVICE demand and energy consumption for group of 33 electrically heated homes in Seattle. Data are for March 14, 1946


Peak demand, 288 kw.*, or 8.73 kw. per house
Energy consumption, 3,308
Average demand, 137.8 kw.
Load factor, 47.8 %
Demand factor, 28.1 %
*Includes transformer and secondary losses
12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12
Noon
FIG. 3

Design Load Box for Service Testing

HARLEY E. ARNOLD
Engineering Dept., Toledo Edison Co.,
Toledo, Ohio



LOAD BOX includes resistor with guard, connection and switching devices, two 15-amp. fuses, 10 ft. of No. 10 R.C., 3-conductor cord, one 2-ft. and one 6-ft. length of No. 14 R.C., 2-conductor cords for voltmeter and ammeter leads

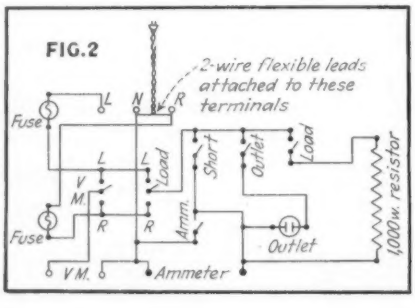
In the design and construction of a device termed a "load box" the primary purpose was to provide a better and easier means of checking poor connections on line secondary or in customers' service entrance. It was also decided to make provisions to test small appliances, such as starting and running current and voltage on washing machine motors, refrigerator motors, etc., which could not otherwise be done without an assistant or without asking the customer to switch the appliance for test.

The load box has a case constructed of ¾-in. plywood, contains two 500-ohm encased resistors, and a base on which are mounted the terminal and switching devices. Connections are shown in the accompanying diagram.

The 2-wire lead (shown in diagram) attached to N-R terminals is used to test 115-volt appliances at a wall outlet. A 3-wire lead for testing on 3-wire lines is connected to the L-N-R terminals and is removed when not in use.

Two 3-way switches are provided to shift the load from left (L) side and neutral (N), to right (R) side and neutral and also to take voltage readings from either side to neutral. Thus an indication may be had as to whether a poor or open connection exists in either of the hot wires or in neutral wire, without the inconvenience of going upstairs to switch load in customer's home.

WIRING DIAGRAM fastened in top of load box



A shunt type ammeter may be used, or a loop may be constructed with banana plugs, to plug into current terminals so that an induction (tong) type ammeter may be used.

The single-pole switches are the indicating type.

A switch marked "short" provides a means for connecting to box appliances that cannot be plugged into outlet receptacle. Caution—this switch is connected directly across the line when the ammeter switch is in the "on" position.

A 50-ft. length of No. 10 three-conductor, flexible rubber-covered wire is used with the assistance of a lineman, to connect the box to line secondary at any pole. A 10-ft. length of same wire is used to connect to customers' service entrance switch for indoor test. It would be well to calibrate both of these leads in order to know approximately the voltage drop occasioned by the load of the resistor.

A list of meters used with the load is as follows:

Shunt ammeter, 0-5-10-amp. range.

Shunt ammeter, 0-25-amp. range.

Weston voltmeter, 0-150-300-600-volt multi-range.

Weston tong type ammeter, 0-10-25-50-100-250-500-amp. range, but the higher ranges are not used with this device.

This device has been used to solve

problems referred to above and it has been found quite satisfactory and very convenient. Approximate cost of material for the unit as shown was $25.00. An added convenience would be to have the multi-range voltmeter and ammeter built into the case. This would, however, entail additional expense.

• • •

Magnesium Anode Protection of Transformer Tanks. . . II*

L. J. GORMAN,
Assistant Engineer,
Consolidated Edison Co.
of New York, Inc.

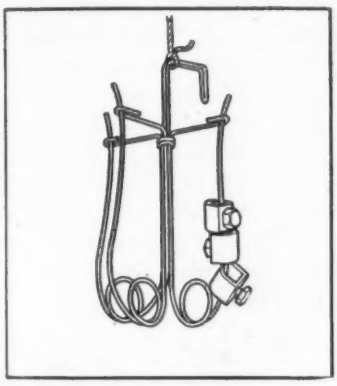
USE OF MAGNESIUM for the mitigation of corrosion on transformer tanks, in wet manholes, has been under investigation, on the system of the Consolidated Edison Co. of New York, Inc., for the past year. In this application, magnesium anodes, of suitable design, were placed in the water in a manhole and connected to the transformers so as to produce a galvanic current which flows, through the water, from the anodes to the transformer tanks. In principle, the cathodic action of this current inhibits the corrosion of any exposed metal on the tank surface. In earlier tests, zinc was used as the anode metal. However, under the test conditions, the results obtained with zinc were not particularly promising. Therefore, the use of zinc was discontinued and the magnesium anodes were substituted. A summary of the conditions, and some of the more significant results obtained in the preliminary tests with magnesium, are given here.

The manhole which was selected for the preliminary tests is located in a tidewater area in which the transformers are completely submerged. The water is substantially sea water, contaminated by various ingredients which are leeched out of the soil, or washed into the manhole from the street surface. The water analysis varied from time to time during the test period. However, the chloride content was approximately that of sea water. The water resistivity varied from 80 ohms-centimeter to 120 ohms-centimeter.

The manhole arrangements, and the location of the magnesium anodes with respect to the three single-phase transformer units, are shown in Fig. 1. Four anodes, consisting of cylindrical castings 3.9 in. in diameter, 18 in. long, and weighing 13.5 lb. each, were connected together and bonded to the transformer tanks as shown. Fig. 2 shows the connections

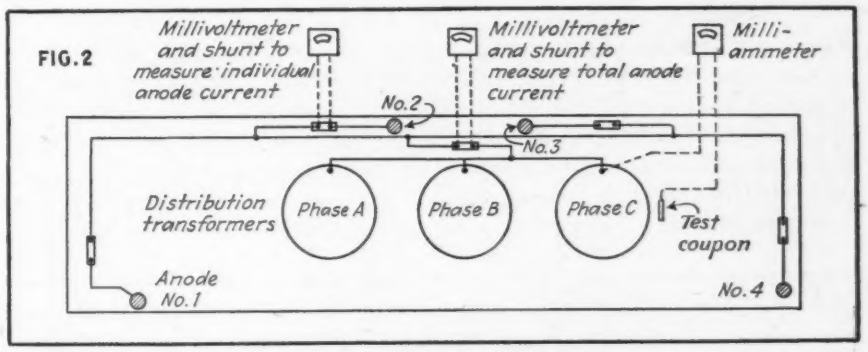
*This series began in ELECTRICAL WORLD, March 29, 1947, page 74. Illustrations are numbered in sequence throughout the series.

"Safety Pin" Type Holder For Solderless Connectors

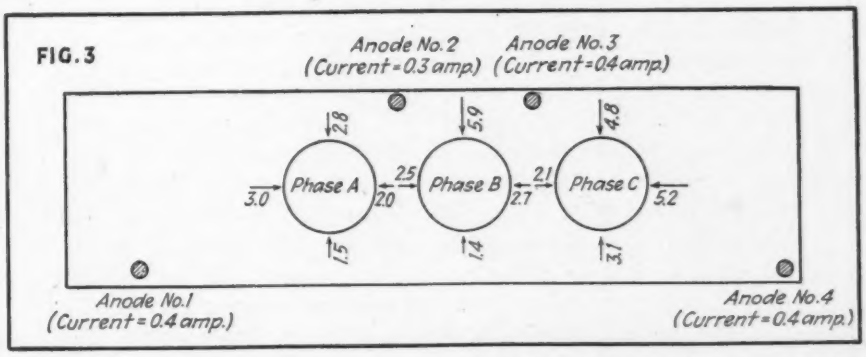


SOLDERLESS CONNECTORS are sent up to linemen on safety clothes-pin type of holder

TO MAKE it easier to send solderless connectors up to linemen on the pole, Jack Addy, Pacific Gas and Electric Co., made up the safety pin type of holder shown. It consists of three large safety pins welded to a hanger wire that will fit over a cross arm. This permits three different sizes of connectors to be sent up the pole quickly and safely and in a manner convenient to the lineman. The device is cheap and easily home made.



METHOD of measurement of anode currents, individual and total



RELATIVE DISTRIBUTION of current. Arrows indicate direction of current in manhole water. Figures indicate average value of milliamperes per sq. in.

used for measurement of the total current delivered by the anodes and that delivered by each individual anode. The density (milliamperes per square inch) and the distribution of the current delivered to the exposed metal was determined by means of a steel plate (2.5 in. x 4 in.) insulated on one side, and held against the transformers at various positions so that the uninsulated surface represented an exposed area on the tank surface. The measurements were taken at four positions around each transformer, and at three levels; top, center and bottom.

The average results of the measurements, made at intervals over a period of approximately 9.5 months, are given in the accompanying table. The current density at each of the test positions varied in relation to its proximity to the anodes. However, the relative distribution of the current, as shown in Fig. 3, remained substantially the same throughout the tests. The vertical distribution at any one position was found to be quite uniform.

Protective value of a deposited coating will be outlined in a subsequent article.

Average Current and Potential Measurements

Elapsed Time, days	Total Anode Current, amp.	Average Current Density At Transformer Tank Surface, milliamperes per sq. in.			Open-Circuit Potential, Anodes To Transformer Tanks, volts
		Phase A	Phase B	Phase C	
0	2.50	5.6	6.0	6.4	1.0
25	1.50	2.4	3.2	4.0	0.45
124	1.45	2.3	3.1	3.8	0.45
287	1.60	2.6	3.4	4.2	0.45

• • •

Rubber Glove Usage Defined by Utility

On an eastern power system, distribution plant involving potentials of 5 kv. or less is worked upon at all times (with exceptions given below) by employees wearing linemen's rubber gloves and leather protectors while:

(1) Climbing or working on overhead structures to which any energized wire or wire which may become energized is attached; (2) Working on the ground on wires attached to or being run on overhead structures as above defined; (3) Setting or removing poles which may contact wires operating at 2.3 kv. or over; (4) Working in underground structures on any exposed conductor of a primary circuit, street lighting circuit, or secondary circuit of over 250 volts.

These specified conditions are not unusual, but the exceptions are seven in number, and of interest from the standpoint of safety:

(1) Rubber gloves need not be used when working on single-phase secondaries in buildings after a check has been made to assure that the voltage is not abnormal and that the surface upon which the operator is to stand is dry and non-conducting. Rubber gloves are worn while the check is being made.

(2) In resetting time switches for street lighting control on lamp posts or below the secondary position on carrying poles.

(3) In replacing globes and lamps between 8 a.m. and 4:30 p.m., provided (a) that the old lamp is not broken and replacement can be done by unscrewing the old lamp from the socket and screwing the new lamp in; and (b) that the work to be done can be performed by the operator from a ladder or on an underground-fed wooden lamp post.

(4) Working on dead aerial cable when cutouts at the branch are opened and red tagged, and the armor wires and phase wires are grounded and not within the scope of physical contact with other wires which are or may be energized.

(5) Bonding lead-covered cables at the top of standpipes, provided the work is not within the scope of physical contact with overhead wires, and dry leather protectors are worn by the operator.

(6) Working on multiple-fed lamp posts between 8 a.m. and 4:30 p.m., provided dry leather protectors are worn.

(7) Rubber gloves may be removed when working on circuits which are totally underground or on an underground portion of a circuit which is completely isolated from the rest of the circuit and which has been grounded and protected by red tag hold-off procedure.

Plastic Protects Cells

Prolongation of shelf life of dry cells even at 130 F. can be extended up to six months if they are given a 1-millimeter coating of a vinyl-resin plastic. This protection has been found by investigators (Hamer, Schrodt and Vinal) at the National Bureau of Standards as far superior to storage in glass, copper cans or metal-lined bags. Batteries sealed in glass without venting relief built up pressures sufficient to result in explosions. Permeability of the plastic coating permits escape of the hydrogen evolved in the action of the cells and "breathing" access of air and water vapor. The studies indicated that drying-out and possibly the action of atmospheric oxygen are the primary causes of battery deterioration at elevated temperatures.

what's new in GE street lighting

Mercury lamp life now rated 6000 hours

Life rating of the 400-watt Types B-H1 and F-H1 mercury lamp, in practical use for 12 years, has recently been increased 20%. Users can now expect a full year and a half of service, on the average, from this lamp (6000 hours, on basis of 10 burning hours per start), with no change in rated efficiency throughout life. The price remains the same.

With this longer life and the corresponding reduction in servicing costs, mercury street lighting becomes even more economical than before.

FOR BUSINESS STREETS AND HEAVY TRAFFIC ARTERIES

Mercury lighting is ideal for most business streets and heavy traffic arteries. The lamp provides a large volume of light, at high efficiency. The color is distinctive; it helps promote the realization that modern lighting is being used. People like it.

NO SPECIAL LUMINAIRES REQUIRED

The types of luminaires used for incandescent lamps are equally suitable for the mercury lamp—and are normally used on initial installations. This is a definite advantage in your standardization program. These luminaires are attractive in appearance, highly efficient, and free from objectionable glare when equipped with mercury lamps —and of course are highly economical.

R.M. Swetland, General Electric application engineer for street and highway lighting, examines the mercury-vapor lamp.

GENERAL ELECTRIC

452-44-3010

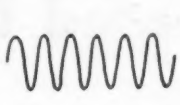
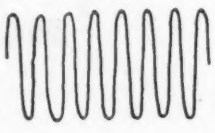
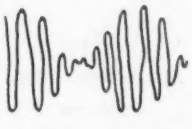
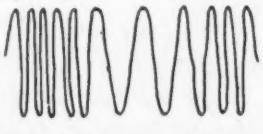
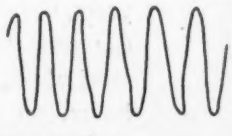
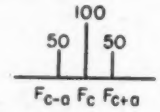
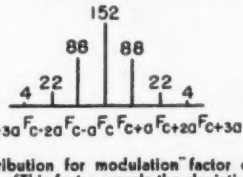
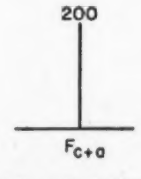
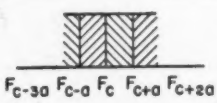
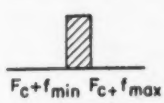
GOOD STREET LIGHTING BUILDS GOOD WILL—Use of the mercury lamp for street lighting is one of many developments which General Electric has pioneered to help you provide better street lighting at lower cost.

For help in determining where you can use mercury lighting to advantage, call our nearest office or write to *Apparatus Dept., General Electric Co., Schenectady 5, N. Y.*

Are you tieing in with the NEMA plan to give America better street lighting?

Comparison of AM, FM, and Single Sideband Systems On an Equal Peak-Power Basis

R. C. CHEEK, Central Station Engineer, Westinghouse Electric Corp., East Pittsburgh, Pa.

ITEM	AM	FM	SS
Transmitted wave, no modulation	 Constant frequency, constant amplitude carrier wave	 Constant frequency, constant amplitude carrier wave	(No signal transmitted in suppressed carrier system)
Transmitted wave, sinusoidal audio modulation	 Frequency constant. Amplitude varies sinusoidally above and below no-signal value.	 Amplitude constant. Frequency varies sinusoidally above and below no-signal value.	 Constant frequency, constant amplitude wave. Frequency equals a reference frequency plus (or minus) the signal frequency. Amplitude proportional to signal amplitude.
Power transmitted during full modulation by speech signals	Average power varies between 1 and 1.5 times unmodulated carrier power. Peak power is 4 time unmodulated carrier power.	Average and peak power continuously equal 4 times unmodulated AM carrier power.	Average power varies between 0 and 4 times unmodulated AM carrier power. Peak power 4 times unmodulated AM carrier power.
Spectrum distribution of components of transmitted wave. Sinusoidal audio modulation. (All components in percent of AM carrier wave.)	 100% Modulation F_c = Carrier frequency F_{c+a} = Carrier frequency plus audio freq. F_{c-a} = Carrier frequency minus audio freq.	 Distribution for modulation factor of 1.0. (This factor equals the deviation ratio D when audio signal of maximum frequency and maximum intensity is being transmitted.)	 Full modulation with peak power equal to peak power of other two systems.
Bandwidth required by system for transmission of audio frequencies from 300 to 3,000 cycles (normal speech band) f_{max} = Highest audio frequency (3,000 cycles) f_{min} = Lowest audio frequency (300 cycles) f_{min} equals 60 cycles during ringing periods if 60 cycle ringing is used.	Total bandwidth equals 2 f_{max} or 6 kilocycles.	 No definite limits, significant sideband components occur over band approximately 3 times f_{max} times deviation ratio (9 kc for f_{max} = 3,000 cycles and D = 1.0)	 Bandwidth equals $f_{max} - f_{min}$, or 2.7 kc for band 300 to 3,000 cycles. Bandwidth equals 2.94 kc for band 60 to 3,000 cycles.
Db gain in signal-to-noise ratio over 100% modulated AM (effect of pre-emphasis not included)	0 db	If noise and signal are comparable, case for which communication becomes difficult with AM, gain is small and may become negative if noise greatly exceeds signal. Gain approaches 10.8 db for D = 1 if signal is several times greater than noise.	9.5 db, independent of relative amplitudes of signal and noise.
Increase in gain afforded by pre-emphasis. T = Time constant of pre-emphasis network. f_{max} = Maximum audio frequency	$db = 10 \log_{10} \frac{2\pi T f_{max}}{\tan^{-1} 2\pi T f_{max}}$ Approximately 8 db for full pre-emphasis	$db = 10 \log_{10} \frac{4\pi^2 T^2 f^2_{max}}{3(f_{max} \frac{1}{2\pi T} \tan^{-1} 2\pi T f_{max})}$ Approximately 8 db (Full pre-emphasis cannot be used because of greatly increased bandwidth.)	$db = 10 \log_{10} \frac{2\pi T f_{max}}{\tan^{-1} 2\pi T f_{max}}$ Approximately 8 db for full pre-emphasis.
Total gain for system with pre-emphasis over AM without pre-emphasis.	8 db	Varies from negative or zero gain under difficult noise conditions to 18.8 db gain under favorable noise conditions.	17.5 db under all noise conditions.

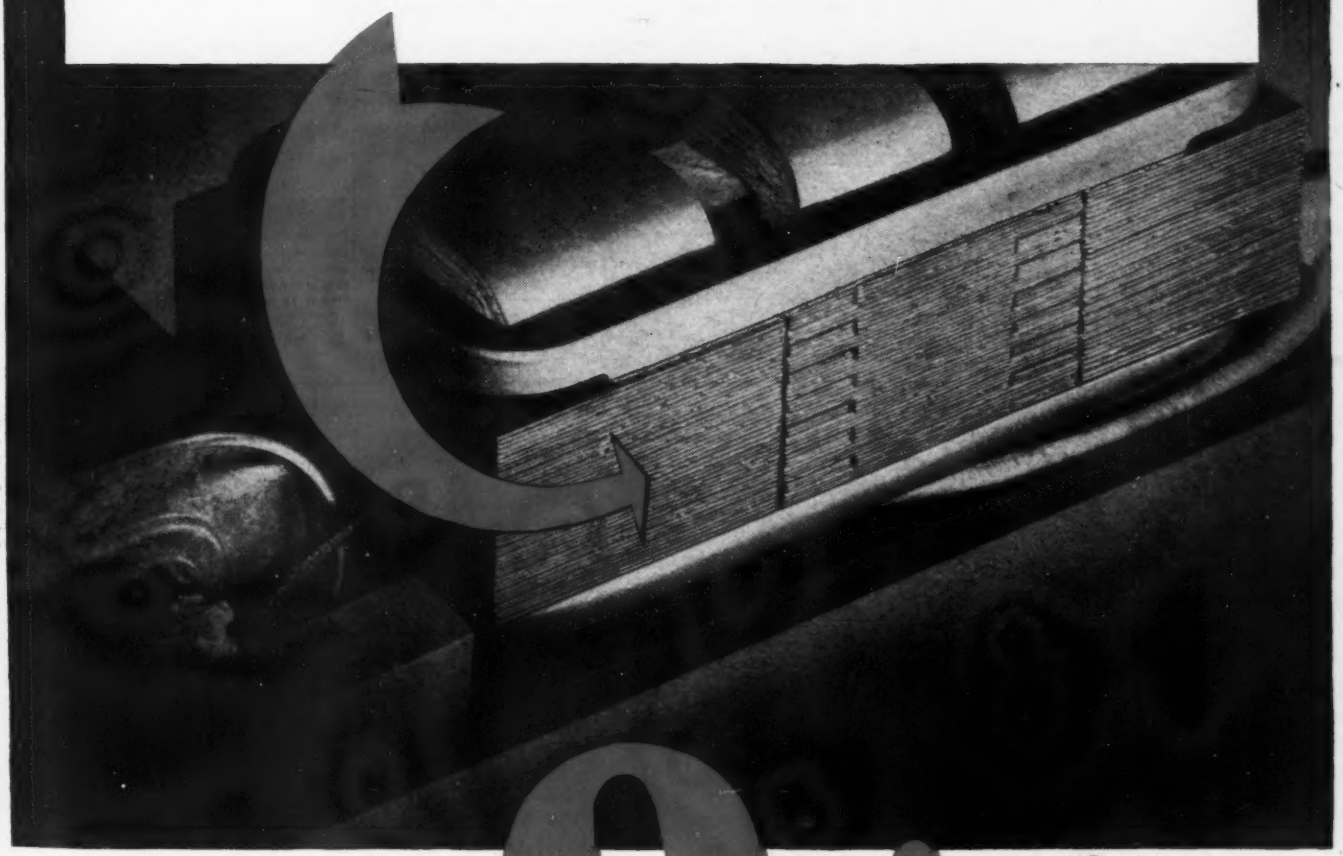
NOTE: The comparisons made in above table are based on equal peak transmitted power in the three systems considered. This basis of comparison gives undue advantage to the FM system because the peak power is transmitted continuously in FM whereas in AM and single sideband transmission the peak power is reached only during speech peaks. However, equal peak power is the only common basis that can be found for comparison of all three systems simultaneously, since no carrier wave is transmitted in the single sideband system. Comparison of AM and FM on the basis of equal *carrier* power gives an advantage of up to 4.8 db for FM, as compared with 10.8 db maximum advantage when equal peak power is used as the basis of comparison.

Comparison of AM and FM on the basis of equal *bandwidth* and equal carrier power requires reduction of the deviation ratio for FM to 2/3, which gives an advantage of only 1.25 db for FM. A single-sideband signal with peak power equal to the peak AM power gives a 9.5 db advantage over AM in less than half the AM bandwidth. Additional gains can be obtained by use of pre-emphasis.

SPECIAL CEMENT KEEPS DOWN HUM

IN G-E FLUORESCENT BALLASTS

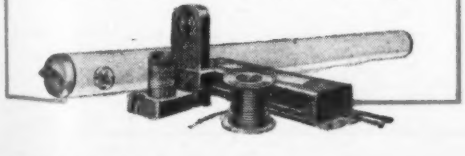
The hum in fluorescent lamp ballasts is produced mainly by the 60-cycle vibration of the thin layers of iron in the core of the transformer. To keep this hum down to the lowest possible level—keep it there for the life of the fixture—G.E. takes special precautions. First, transformer core laminations are firmly bound by heavy-duty steel clamps. Then the core is thoroughly coated with a hard-setting cement specially adapted to the job. When this cement sets, the core becomes a solid structure, with all air gaps permanently sealed. Finally the assembled ballast is filled with compound which serves to further dampen hum, as well as to carry off heat.



Quiet pleases

We realize you are not getting all the G-E ballasts you need as quickly as you want them; but please remember that we are doing our utmost to increase production, despite continuing material shortages.

BALLASTS LAMPS STARTERS
CABLE LAMPHOLDERS
for
DEPENDABILITY in fluorescent lighting



Yes, the quiet operation of General Electric ballasts can be an important factor in making friends for your fluorescent fixtures. So can their ability to ensure rated lamp life and light output.

Apparatus Dept., General Electric Company, Schenectady 5, N. Y.

GENERAL ELECTRIC

412-6-5806

Carrier and Radio Frequency Resistance For Annealed Bare Copper Wire*

Resistance values for solid and stranded conductors of commonly used sizes and at various radio frequencies

Carrier and Radio Resistance In Ohms per 1,000 Ft.

For Annealed Bare Copper Wire (20 C.)

Size A.W.G.	FREQUENCY IN KILOCYCLES											
	300	500	1000	2000	4000	8000	10,000	20,000	30,000	40,000	50,000	100,000
SOLID CONDUCTORS												
4/0	1.25	1.60	2.26	3.20	4.51	6.40	7.10	10.00	12.50	14.50	16.10	23.8
2/0	1.53	1.99	2.80	4.00	5.60	7.95	8.90	12.65	15.50	18.00	20.00	28.2
1/0	1.72	2.22	3.15	4.45	6.30	8.90	10.00	14.10	17.20	20.00	22.20	31.0
2	2.19	2.81	4.00	5.60	8.00	11.20	12.50	17.90	22.00	25.30	28.10	40.0
4	2.78	3.58	5.05	7.07	10.20	14.00	15.60	22.10	27.10	31.20	35.00	48.6
6	3.43	4.44	6.30	9.00	12.70	18.00	20.10	29.00	35.50	41.10	46.00	65.0
8	4.30	5.59	8.00	11.30	16.15	23.00	25.85	37.20	45.80	53.30	59.60	84.5
10	5.41	7.00	10.00	14.10	20.00	28.20	31.50	45.30	55.70	64.50	72.00	103.0
12	7.00	9.03	12.70	16.10	25.25	35.20	39.50	56.00	68.50	79.00	87.90	123.0
14	9.00	11.50	16.20	22.75	31.55	45.15	50.50	71.50	86.60	100.00	122.00	155.0
16	11.40	14.60	20.40	28.80	40.00	56.00	62.00	88.00	107.00	124.00	137.00	191.0
18	14.50	18.70	26.20	36.65	51.00	71.60	79.50	112.00	136.00	157.00	175.00	242.0
20	18.60	23.80	33.80	46.60	64.90	91.40	101.40	142.00	173.00	200.00	222.00	310.0
22	25.20	32.20	43.75	59.20	82.10	114.80	126.20	190.00	231.00	268.00	298.00	413.0
24	32.30	41.50	56.40	76.90	106.80	147.70	164.20	229.00	277.00	315.00	350.00	480.0
26	43.40	54.60	73.10	98.30	131.00	187.60	208.00	281.00	340.00	386.00	429.00	585.0
28	61.00	75.80	93.60	125.00	170.50	233.80	260.00	357.00	430.00	489.00	541.00	742.0
30	103.00	111.00	127.00	167.00	226.00	308.00	340.00	462.00	552.00	630.00	695.00	943.0
STRANDED CONDUCTORS												
7 x 0.010	28.1	34.8	46.5	62.5	84.0	120.0	130.0	175.0	195.0	225.0	250.0	330.0
19 x 0.010	9.8	15.2	20.9	29.0	40.0	54.9	60.9	83.5	102.0	120.0	137.0	178.5
7 x 0.0253	7.75	11.9	16.5	23.0	32.0	44.1	49.0	68.0	82.0	93.5	109.5	150.0

Notes: 1. Odd A.W.G. sizes (not shown) may be interpolated with reasonable accuracy.
2. Close spacing of A.W.G. sizes No. 6 and larger causes a perceptible increase in the above values for these sizes due to proximity effects. The values indicated in the table for these sizes are based on a conductor separation greater than 18 times the wire diameter.
3. The resistance values in the above table for frequencies of 20,000 kc. and higher are only approximate.

* From advance pages of a forthcoming technical manual to be issued by Rome Cable Corp., Rome, N. Y

Announcing 2 NEW CURRENT TRANSFORMERS

Designed to Withstand ASA Full-wave Impulse Tests

TO ASSURE top performance of your meter, relay, and control devices, install the new JKL-3 current transformer on 2400- and 4800-volt lines and the new JKL-4 on 6900-volt lines. Both transformers are built to American Standards Association specifications. These call for transformers such as the JKL-3 to withstand a 19-kv test at 60 cycles and a full-wave impulse test at 60 kv. Similarly, the JKL-4 is designed to withstand a 26-kv test at 60 cycles and a full-wave impulse test at 75 kv.

Accuracy—The JKL-3 and JKL-4 are designed for accurate metering over the normal current range up to 100 per cent of rating, and also for relay operation up to 20 times rated current. The accuracy classification for both transformers is as follows:

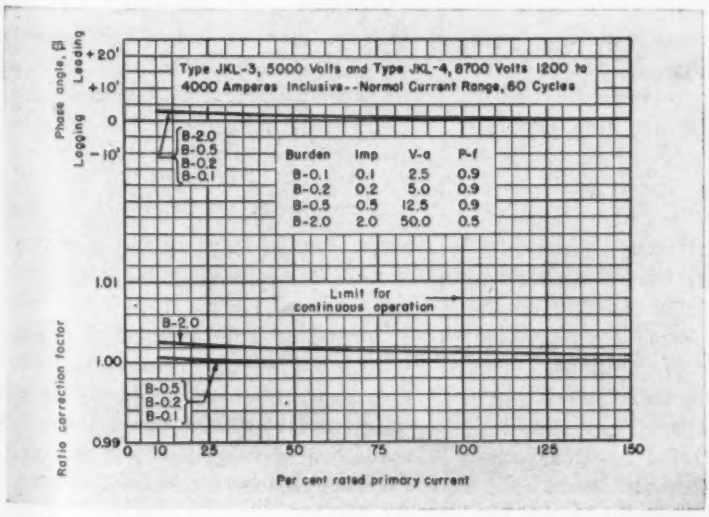
ASA (Meter) 60, 50, and 25 cycles

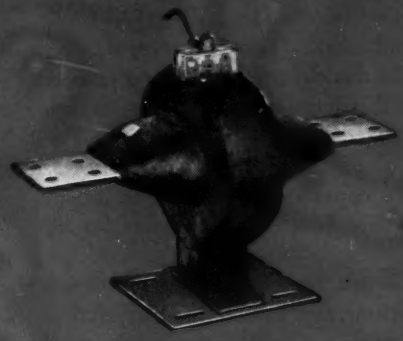
Burden	B-0.1	B-0.2	B-0.5	B-2
Classification	0.3	0.3	0.3	0.3

ASA (Relay) 60 cycles, 2.5 H 100

Construction—Of sturdy bar-primary construction, these transformers owe their unusually great electrical strength to the use of new insulating materials and advanced manufacturing techniques. The circular core is of nonaging silicon steel, carefully selected, tested, and annealed under rigidly controlled conditions. This assures the transformer of long-life accuracy.

Ratio and Phase Angle Characteristic Curves



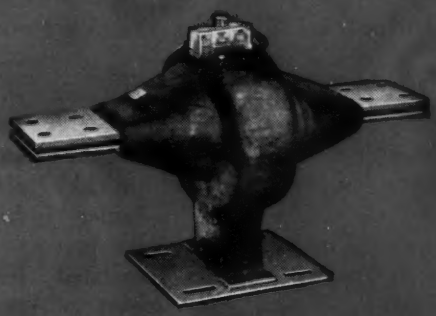


THE JKL-3

Rated 5000 volts, 1200 to 4000 amperes.

Designed to withstand ASA full-wave impulse tests at 60 kv.

Available with single-, double-, or triple-bar primary.



THE JKL-4

Rated 8700 volts, 1200 to 4000 amperes.

Designed to withstand ASA full-wave impulse tests at 75 kv.

Available with single-, double-, or triple-bar primary.

YOU CAN get prices, lists of ratings, and other descriptive information by asking your G-E office for Bulletins GEA-4591 and 4592. Or write today to General Electric, Schenectady, N. Y.

GENERAL ELECTRIC

604-17-8408

II—Trend to Three-Wire Service Shown in Survey*

ADEQUATE WIRING promotion and assistance to builders in planning outlets and wiring circuits have increased average wiring capacities in many localities, but there is still a general tendency to use the minimum requirements of the National Electrical Code as a standard. There are several practices of the electric supply companies, beyond advertising and sales activities, that influence wiring plans. The most definite step is an increase in service capacity through adoption of three-wire meters and services for all residences.

This practice has helped in voltage conditions and in keeping the current unbalance as small as possible, and multiplies the individual service capacity in the most economical manner possible. A survey among 33 companies show two-thirds now using three-wire services and meters for practically all single-family dwellings. Some exceptions are noted by 15 of the 22 companies with this provision.

Ten companies supply two-wire services if the load requirements are such that only one branch circuit is wired, and five companies permit two branch circuits. It is probable that the others also take the minimum loads on two wires, particularly in the case of camps or temporary housing.

Eleven of the 33 companies have no provision in their regulations and will install service and meter for either three-wire or two-wire connections if the arrangements meet the minimum requirements of the National Electrical Code. Two of these companies are buying only three-wire meters, but have enough two-wire meters coming in from change-overs to provide for two-wire services where they are wired at present.

The division of practice does not follow any company size or geographical pattern, and it is not entirely related to the saturation or promotion policy on electric ranges. The 22 companies using three-wire meters now have a grand total of 5.2 million customers and there are 2.3 million customers served by the eleven companies still using both two-wire and three-wire meters.

This ratio is further checked by a recent summary of residence type meters manufactured, with between 60 and 70 percent three wire during the past year.

N. E. C. Required

It is noteworthy that recently issued revisions of service rules and information give more attention to three-wire requirements and wiring recommendations than do those booklets with older dates of issue. The attention that is given to service requirements is not, however, related to the use of printed instructions or booklets, and the ratio of two-wire and three-wire service requirements was the same among the companies without booklets as in the total group in this survey of practices.

Reference is made to the National Electrical Code in all except three of the printed or drafted rules and regulations. City ordinances or "authority having jurisdiction" are referred to in the three cases. A typical statement of the nature of company regulations is "supplementary and do not intentionally conflict with the National Electrical Code or local and state laws in force in the communities in which the Company furnishes service."

Inspection and approval of wiring is required before service connections are made, wherever authority is required before service connections are made, wherever authority is provided for such inspection. One company recommends, but does not require, inspection where legal authority is not provided, and one company will make inspections as a service for its cus-

* A series on Service Rules which began in ELECTRICAL WORLD, March 29, 1947, p. 73.

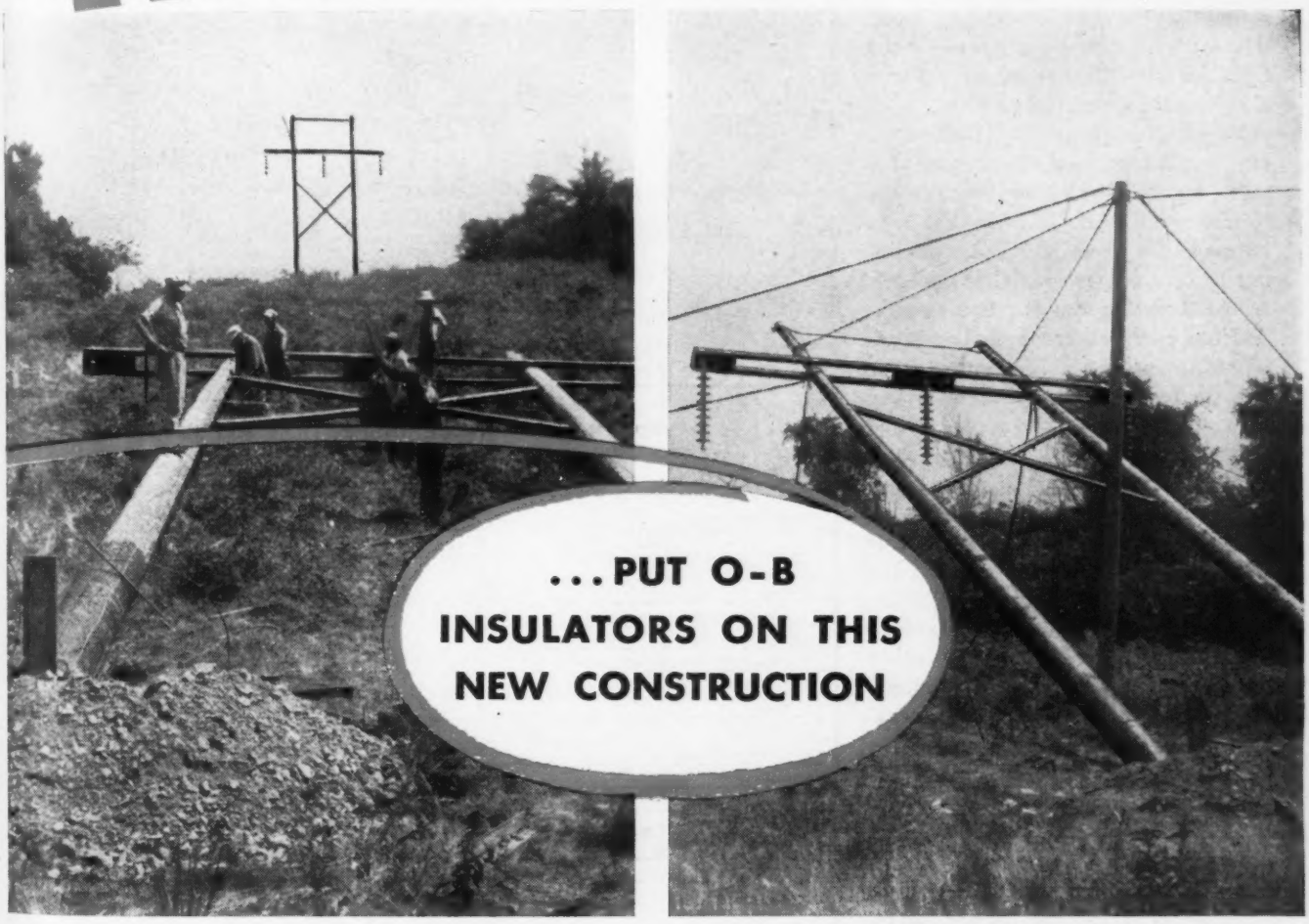
Industrial Electric Trucks Provide Minimum Fire Risk

THE USE of industrial trucks and tractors inside factories introduces hazards common to all moving material handling units, but fire risks are greatly reduced by battery-operated equipment, according to a recent analysis by the Associated Factory Mutual Fire Insurance Companies, Boston. In a recent 17-year period, of eleven fires reported to the Associated companies from battery-powered trucks, eight were due to wiring short-circuits, one to sparks from switches, one from current left on inadvertently, and one unknown cause. In contrast, during the above period there were 121 fires involving gasoline-powered trucks and tractors, of which 71 were caused by gasoline spilled during refueling and ignited in but 20 of these cases by electrical ignition systems and 4 from outside sparks.

The excellent fire record of the electric trucks is due partly to the use of motors, controllers and switches with general purpose enclosures, and to wiring protected from mechanical injury and from soaking by oil and grease. Battery-powered trucks can be used in practically all industrial occupancies with safety, and this includes textile or other processes involving the storage and handling of combustible fibers. For extra-hazardous locations involving inflammable vapors or dusts and requiring special safety type electrical equipment, trucks with dust-tight or explosion-resisting enclosures for motors are available under proper limitations. The Factory Mutual Laboratories have not made a special investigation of battery-operated trucks because their fire hazard is so low. Higher initial cost is offset by longer life for electric trucks.

IS GOOD REASON FOR

INSULATORS



In view of the records made by the lines on the opposite page it is only logical that O-B insulators were chosen for the extended facilities of this same operating company

2746-H

Ohio Brass

MANSFIELD, OHIO

Canadian Ohio Brass Company, Limited
Niagara Falls, - - - Ontario

HEADQUARTERS FOR PORCELAIN INSULATION

tomers. In two cases, an affidavit by the contractor is accepted where there is no authorized inspection.

Larger Service Entrances

In general, No. 6 wire service entrances have accompanied three-wire requirements. Specifically, 14 of the company manuals state the requirement of No. 6 wire as a minimum, and two of them recommend No. 4 as minimum. Exceptions are noted as with the requirement for three-wire service, for installations of one or two branch circuits. Four of these companies suggest use of No. 8 wire for the neutral. Three companies refer to No. 8 wire service entrance as minimum.

Capacities required for residence service wiring and equipment are, of course, subject to theoretical calculations for adequacy based on floor areas. Total load determined by size of the dwelling, however, does not take into account the many appliances which may be added in any home. It has been estimated that more than 50 percent of single-family residences have wiring of the original design for lighting only, with two No. 10 or No. 8 wires in the entrance and with two branch circuits. Larger capacities have been adopted for new services to avoid expensive changing with later additions of appliances.

• • •

A Guide for Manhole Inspections—II*

FORMS for reporting manhole inspection as outlined here are an adaptation from instructions issued by the Distribution Division of an Eastern electric utility company.

Every cable splicer is to make a report on a specified form card for every manhole which he enters in the course of his work, i.e., a report is to be made for every manhole containing 13.2-kv. cables which has not been reported during the previous month, and for every other manhole not reported the previous six months. These reports (see Fig. 2 and Fig. 3) are then turned in to the general line foreman, who will initial them and send them to the joint line representative.

There is kept on file a "Record of H. T. Manhole Inspection" card for every manhole containing 13.2-kv. cables and a "Record of Manhole Inspection" card for every other manhole. These cards are filed alphabetically by streets and kept in separate compartments. Every card for a manhole which is connected to the sewer system is to have fastened to it a brass clip of the "O.K. fastener" type. The data contained in the reports turned in by the cable splicer foreman is transferred to the corresponding cards.

Reports of the presence of gas are to be reported immediately to the gas company by the general line foreman and he is to record this fact on the "Manhole Inspection Report."

A regular "Record of Manhole Inspection" card is kept for each manhole on the "gas test" list. These

M.H. No. LOCATION

RECORD OF H.T. MANHOLE INSPECTION
MANHOLE INSPECTED

Date	By	Condition	Date	By	Condition

FIG. 2—Card (6 in. x 4 in.) used to record results of inspection

WORKING, MANHOLE INSPECTION REPORT

M. H. NO. LOCATION

INSPECTED BY DATE

ITEM	O K	ITEM	O K
1 COVER AND FRAME		15 APPARATUS	
2 GAS		(A) JUNCTION BOXES	
3 WALLS—ROOF—FLOOR		(B) OIL SWITCHES	
4 CABLE RACKS		(C) OIL FUSES	
5 CABLE JOINTS AND SHEATH		(D) TRANS. MULTIPLE	
6 ENDBELLS—FAIRLEADERS		(E) TRANS. ST. LTG.	
7 TAGS		(F) VENTILATING EQUIPMENT	
8 BONDING			
9 FIREPROOFING			
10 DUCTS			
11 DUCT SEAL-PLUGS			
12 DIRT—RUBBISH			
13 WATER			
14 VENTILATING EQUIP.			

FOLD HERE

DATE: M. H. NO.

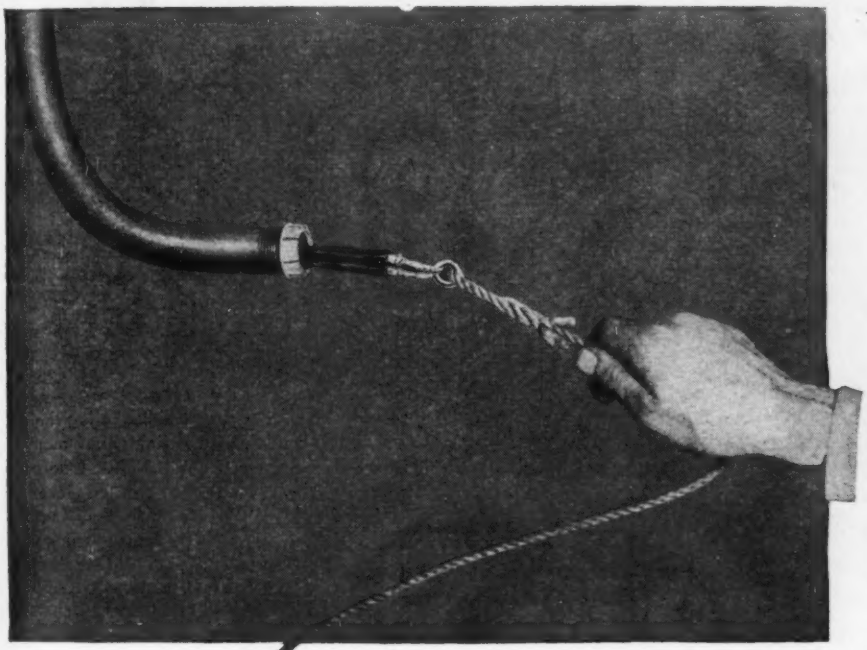
REPAIRS:—NEEDED, NOT NEEDED, COMPLETED, DATE:

REMARKS. DESCRIBE NEEDED REPAIRS, USING ITEM NO. AS KEY.

FIG. 3—Folded report form (6 in. x 8 in.) used in the field

*Concluding the series which began in ELECTRICAL WORLD, March 29, 1947, page 84.

Less Pull MORE SPEED



● The smooth, waxed, low-friction surface of General Electric's thermoplastic building wires shows up in *time saved* when pulling wires through conduit. Compared to other types of wire of equal capacity, it takes less "pull," makes fishing easier when joints and angle bends are encountered. And the tough, abrasion-resistant finish protects the insulation from possible damage.

No wonder General Electric thermoplastic has moved up so fast as a favorite among contractors and their customers alike. For, in addition to its smooth surface, it has cost-saving advantages *all the way through.* It strips easily. It is practically nonaging. It is virtually unaffected by oil or water. It has made possible building wires of small diameter, without lowering insulation standards.

Don't risk buying, or specifying, building wire by type alone. First, get all the facts about General Electric's thermoplastic building wire by writing to Section W58-427, Appliance and Merchandise Department, General Electric Company, Bridgeport 2, Connecticut.

Thermoplastic
First . . . and foremost
Type T Building Wire

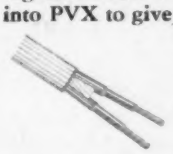
GENERAL ELECTRIC

AROUND THE CIRCUIT with your G-E Merchandise Distributor

G. E. OFFERS A COMPLETE LINE OF BUILDING WIRES

Besides G-E thermoplastic, Types T and TW, for dry and wet locations, there's standard code grade building wires, Types R and RH, (Type RH in sizes 6 Awg and larger can often be used more rating). In addition, G. E. offers Types RW (moisture resistant), RD (flat twin-braided building economically than Type R, because of its higher current wire), and RL and RHL (leaded cable construction).

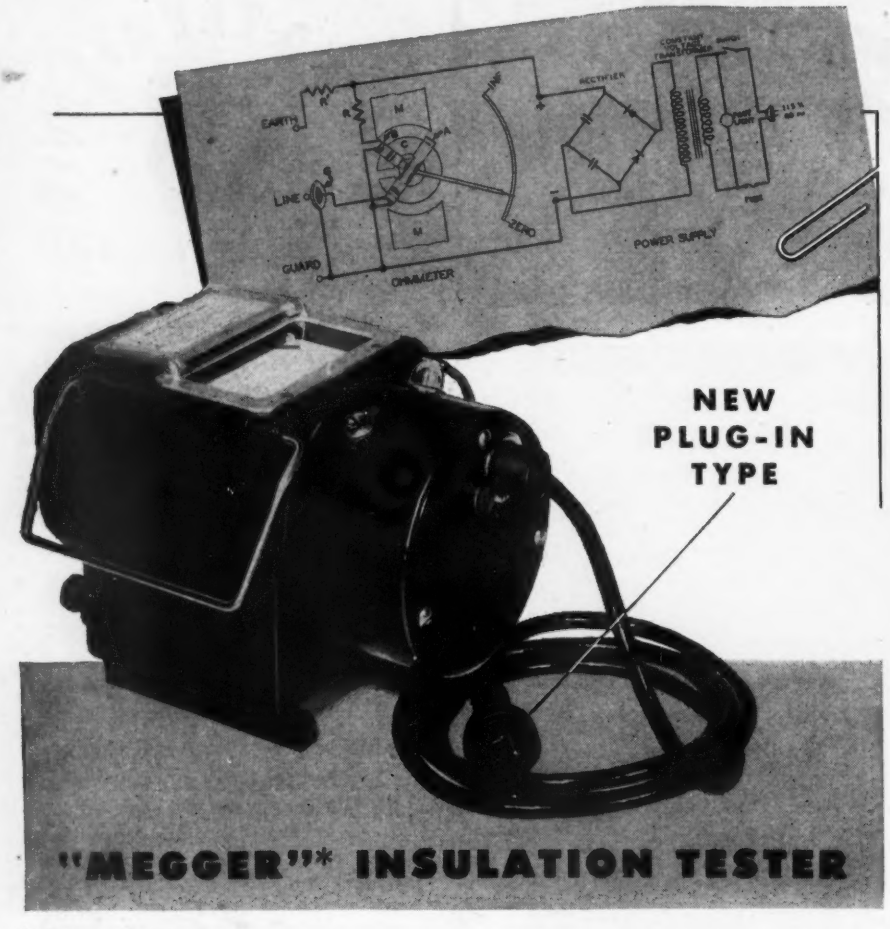
THERMOPLASTIC INSULATION PLAYS AN IMPORTANT ROLE in cable insulation today, too. Take PVX, for instance. This nonmetallic sheathed cable is lighter, has smaller diameter, and is more flexible than ordinary cables. These features are the result of skilled engineering in cable construction. They are built into PVX to give you easy handling, to speed installation, and to *keep PVX on the job* after it has been installed. Let us give you more information on this outstanding cable. You'll find many uses for it.



A DOZEN BATHS A DAY may sound like overdoing things, but not when you are talking about General Electric's testing laboratories. Here, samples of wire, or cable, are immersed in oil or water and tested for dielectric strength and insulation resistance. Many thousand tests for these and other properties have been made for your protection. These careful checks on quality mean that when you order any General Electric wire or cable, you can always be sure that it will perform long and well when put in service.

BX* GOLDEN ANNIVERSARY — Fifty years ago General Electric introduced BX armored cable. Today, the improved BX cable is manufactured with a bonding strip to assure low value of armor resistance. Let us show you a sample.

*Trade-mark Reg. U. S. Pat. off.



"MEGGER"* INSULATION TESTER

FOR those who need or prefer a "Megger" Insulation Tester that can be "plugged in" instead of hand-cranked, we have developed the *rectifier-operated* instrument here illustrated. Simply connect to 115-volts a.c., flip a switch and proceed immediately to make tests.

This instrument is especially useful where a large number of tests are to be made at one time, and also where an individual test is continued for many minutes.

TYPICAL APPLICATIONS ARE:

1. Testing control circuits and other equipment in power plants.
2. Testing extensive lighting and power installations.
3. Testing generators, cables and other equipment in which the dielectric absorption effect is significant. Such tests involve careful observations of changes of insulation resistance with time up to 10 minutes or more.
4. Testing multi-conductor communication cables, as in telephone plant.
5. Testing control and power circuits in railway signal installations.
6. Production testing of all types of electrical equipment and components.
7. Experimental and laboratory use.

The rectifier-operated instrument is essentially a modification of our U.S.-made "Meg" type Insulation Tester. The hand generator is replaced by a "power pack" consisting of a constant-potential step-up transformer and selenium rectifier, giving a constant d-c test voltage. The "Megger" true ohmmeter covers a wide range and is independent of the supply voltage. A switch, pilot light and connecting cable are included. The instrument is available in various ratings up to 2000 megohms and 1000 volts. For further details write for preliminary *Bulletin 24-46-W.*

*REG. U. S. PAT. OFF.

James G. BIDDLE CO.

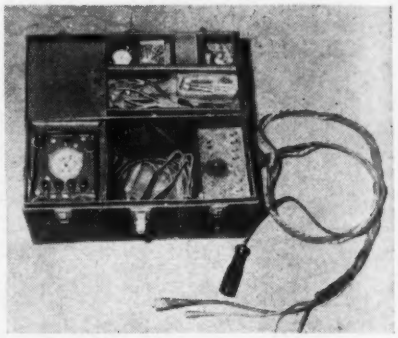
ELECTRICAL & SCIENTIFIC INSTRUMENTS

1316 ARCH STREET • PHILADELPHIA 7, PENNA.

cards are marked in red type "For Gas Only." Each test is recorded on the proper card under the direction of the maintenance engineer. These cards are filed separately from the regular record of manhole inspection cards.

•

All Meter Testing Needs in One Kit



SOME meter test men still like to lug their equipment as individual items, but many prefer a self-contained test kit. One of the latter type, made up by H. D. Noren, Coast Counties Gas & Electric Co., Santa Cruz, Calif., contains the standard in one end of a metal box, phantom load at the other, and space between for the leads. A tray containing tools and parts fits into the right hand end of the box. An important feature of this kit is that it is permanently wired to a lock-type receptacle in one end where the leads are plugged in when making a test. A wide canvas strap passing around the box endwise makes it easy to carry the kit

•

A Stronger Magnetic Alloy

A NEW MAGNETIC ALLOY, reportedly capable of attracting and holding metallic objects almost 300 times heavier than itself, has been developed, after many years of experiments by three Soviet scientists—A. Zaimovski, B. Lifthits and K. Nashcokin. Success came after a trial and error method involving tests of several thousand various alloys.

A small plate made of this alloy—called "Magnico-627"—was subjected to thermal treatment and then magnetized by electric current. Suspended on a wooden chuck, this small magnet, weighing only 90 grams, pulled up a load weighing 55.11 lb. which it has been holding for two years.

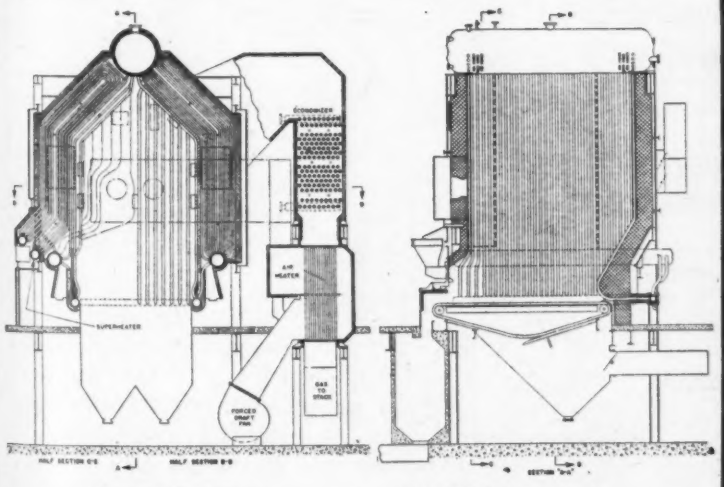
A portable magnet made of this alloy was successfully used recently for the extraction of fragments of a

# of your Dollar

Look at the table and see how near Foster Wheeler can bring you toward realizing a dollar's worth of steam for a dollar's worth of fuel. Then look to a leader when you are ready to install a new steam generating unit in your plant.

Foster Wheeler Corporation
165 Broadway, New York 6, New York.

NUMBER OF UNITS	CAPACITY LB. PER HOUR	PER CENT EFFICIENCY
2	640,000	86.04
1	400,000	83.07 (gas) 87.55 (oil)
1	375,000	85.18
1	325,000	85.11
4	216,000	84.
1	300,000	86.89
2	300,000	84.81
1	500,000	88.50
1	385,000	88.40
2	250,000	87.05
1	250,000	83.80
2	215,000	84.24
4	120,000	86.88
2	175,000	82.17
1	77,500	85.



Steam Capacity . . . 75,000 lb. per hour
Efficiency . . . . . 85 per cent

WHEELER FW

Here's Why!
. . . . TIREX WELDING CABLES PROVIDE THAT EXTRA FLEXIBILITY THAT SAVES LABOR, TIME, AND MONEY ON DIFFICULT OPERATIONS!!!
SIMPLEX—TIREX—WELDING—SINGLE #3/0 2695

Yes, TIREX* does represent all-around savings because it is especially designed with a separator of soft cotton braid.

Unlike the conventional paper tapes and heavy cotton winds applied to other welding cables, this pliant braid does not bind the conductors. It allows full play on every last bit of flexibility their fine stranding produces, and thus reduces the strain imposed by long and laborious jobs.

Work is speedier, production is greater when welding is done with ease. To get the most from your welders, be sure they get the most from their equipment. For non-kinking flexibility, clean-stripping, and dependable service specify Simplex-TIREX, the only welding cables protected by the tough, long-lasting Selenium-Neoprene Armor.

TIREX SELENIUM Neoprene Armor

*Trade Mark Reg. U. S. Pat. Off.

Simplex-WIRES & CABLES

SIMPLEX WIRE & CABLE CO. 79 SIDNEY ST. CAMBRIDGE 39, MASS.

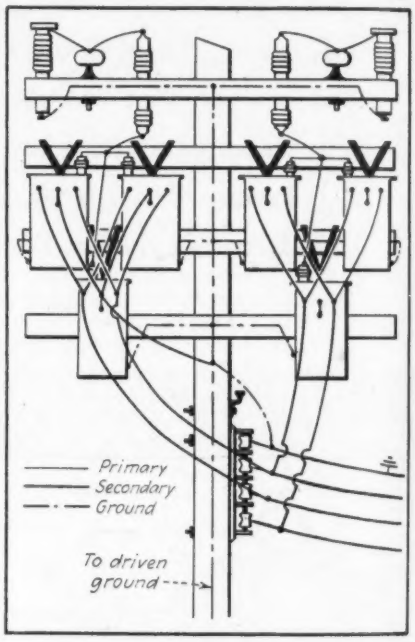
broken oil drill from an oil well 4,921 ft. deep. The job took only a few hours compared with the usual six weeks by ordinary methods.

"Magnico-627" is in use by Soviet doctors for the extraction of metallic particles from the eye. Large magnets are produced from this new alloy for high-capacity radio-loudspeakers with a range of 12½ miles.

•

Six Transformers Pinch Hit For Two

JAMES EAST
Local Manager
Mississippi Power & Light Co.
Gloster, Miss.



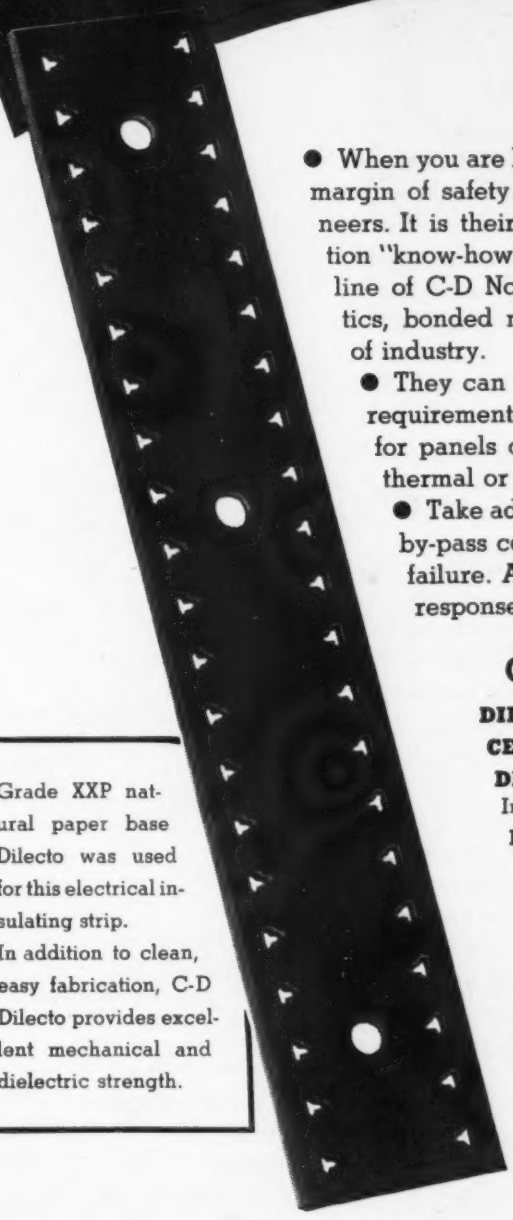
POLE ARRANGEMENT of six 5-kva. transformers in vee-connection serve in place of two unobtainable 10 or 15-kva. units

IN THE CHANGEOVER from steam-power to purchased electric service by the William Wester Pepper and Milling Co., near Gloster, Miss., an unusual transformer installation was made on a nearby pole by the Mississippi Power & Light Co. This plant produces dried and ground red pepper, is operated seasonally and was powered by a 45-hp. engine.

Electric load for the plant is 30 kva. Unable to obtain either 10-kva. or 15-kva. transformers, the utility company was obliged to install six 5-kva. transformers. The pole mounting arrangement and scheme of connections are shown in the illustration.

If it's an Insulation Problem . . . this is the name to know.

Continental·Diamond
C – D
Engineered Non-Metallics



Grade XXP natural paper base Dilecto was used for this electrical insulating strip.
In addition to clean, easy fabrication, C-D Dilecto provides excellent mechanical and dielectric strength.

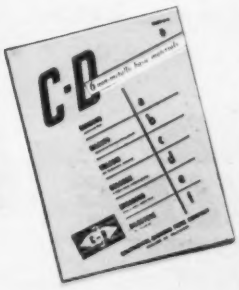
● When you are looking for better product performance . . . a greater margin of safety in electrical equipment—discuss it with C-D engineers. It is their application experience, coupled with C-D production "know-how", that has led to the development of the complete line of C-D Non-Metallics: molded macerated and laminated plastics, bonded mica and fibre products to meet the specific needs of industry.

● They can advise you which materials best meet high voltage requirements, which should be used for high frequencies, which for panels or instrument cases, as well as those best suited for thermal or moisture conditions.

● Take advantage of this specialized, practical experience and by-pass costly errors in your planning that may cause product failure. A call to our nearest office will find a ready, helpful response from C-D engineers.

C-D NON-METALLIC PRODUCTS

DILECTO—Thermosetting Laminated Plastics.
CELORON—A Molded Phenolic Plastic.
DILECTENE—A Pure Resin Plastic Especially Suited to U-H-F Insulation.
HAVEG—Plastic Chemical Equipment, Pipe, Valves and Fittings.
DIAMOND Vulcanized FIBRE.
VULCOID—Resin Impregnated Vulcanized Fibre.
MICABOND—Built-up Mica Electrical Insulation



STANDARD & SPECIAL FORMS

Available in Standard Sheets, Rods and Tubes; and Parts Fabricated, Formed or Molded to Specifications.

DESCRIPTIVE LITERATURE

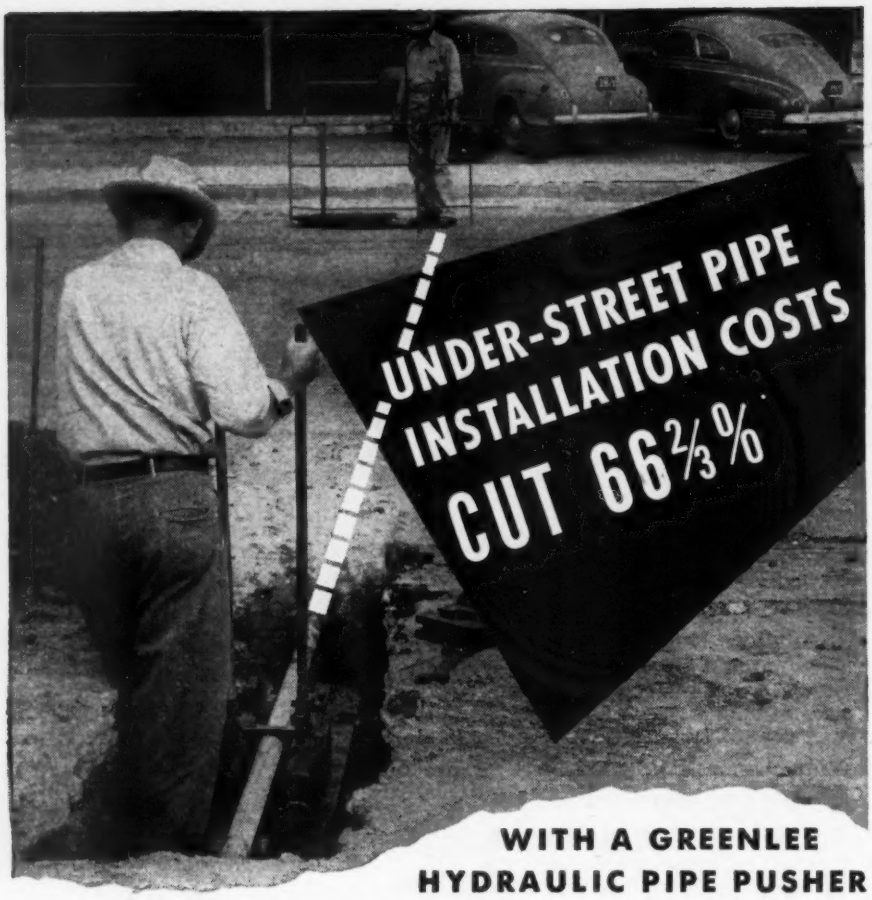
Bulletin GF gives Comprehensive Data on all C-D Products. Catalogs are also available.

D-2-47

BRANCH OFFICES: NEW YORK 17 • CLEVELAND 14 • CHICAGO 11 • SPARTANBURG, S. C. • SALES OFFICES IN PRINCIPAL CITIES
WEST COAST REPRESENTATIVES: MARWOOD LTD., SAN FRANCISCO 3 • IN CANADA: DIAMOND STATE FIBRE CO., OF CANADA, LTD., TORONTO 8

Continental-Diamond FIBRE COMPANY

Established 1895..Manufacturers of Laminated Plastics since 1911—NEWARK 15 • DELAWARE



WITH A GREENLEE HYDRAULIC PIPE PUSHER

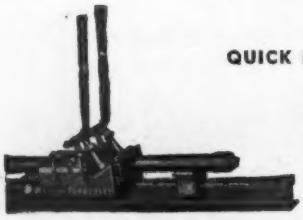
Installing conduit under Houston's busiest streets and railways is simple, fast work for Houston Power and Lighting Company. No torn up pavement there...no traffic tie-ups...no extensive trenching, tunneling, backfilling, re-paving.

For they let a GREENLEE Hydraulic Pipe Pusher do the heavy work. On the job above, 2-inch conduit was pushed 40 feet in less than an hour and a half...*and the street was not disturbed.*

"Without the pusher," reports the company, "this job would have cost us three times as much to do. And on another job of installing pipe under tracks, we cut installation costs to one-tenth of that of any other method."

Proof again that wherever you find a GREENLEE you find underground piping jobs going faster, more efficiently, more economically. For complete facts about this equipment which "pushes" pipe *under* streets, sidewalks, lawns, floors and other obstacles—write Greenlee Tool Co., 1804 Columbia Avenue, Rockford, Illinois.

REGISTERED TOOLS
GREENLEE
FOR THE CRAFTSMAN



QUICK FACTS ABOUT THE GREENLEE HYDRAULIC PIPE PUSHER

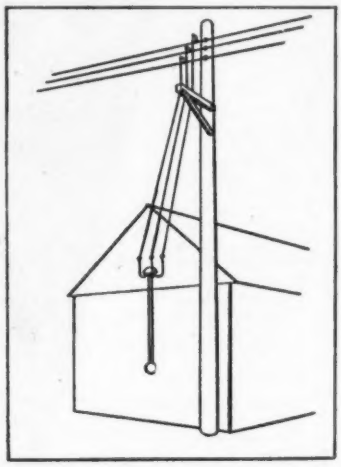
Easy—one or two men can easily operate on any job. *Portable*—compact, easy to carry to job and set up. *Fast*—operates at six different speeds. *Two models*—(1) for pipe up to 4-inch; (2) for larger pipe, drainage ducts, concrete sewer pipe. Do the job easier, quicker with a GREENLEE.

Primary power is 8 kv. to ground and is supplied by two phases of the system. Secondary supply is 220 volts, 3 phase and 110 volts, single phase. At the pole ground connections are made to a common neutral and driven ground.

This pole installation includes two kingpost insulators, two 15-kv. lightning arresters, and two Kearney Trip-O-Link switches, all mounted on a single crossarm; the six transformers mounted on two sets of double arms; and a single or kicker arm used for the two lower transformers. All transformer tanks are grounded to the common neutral.

How To Make Short Service Runs

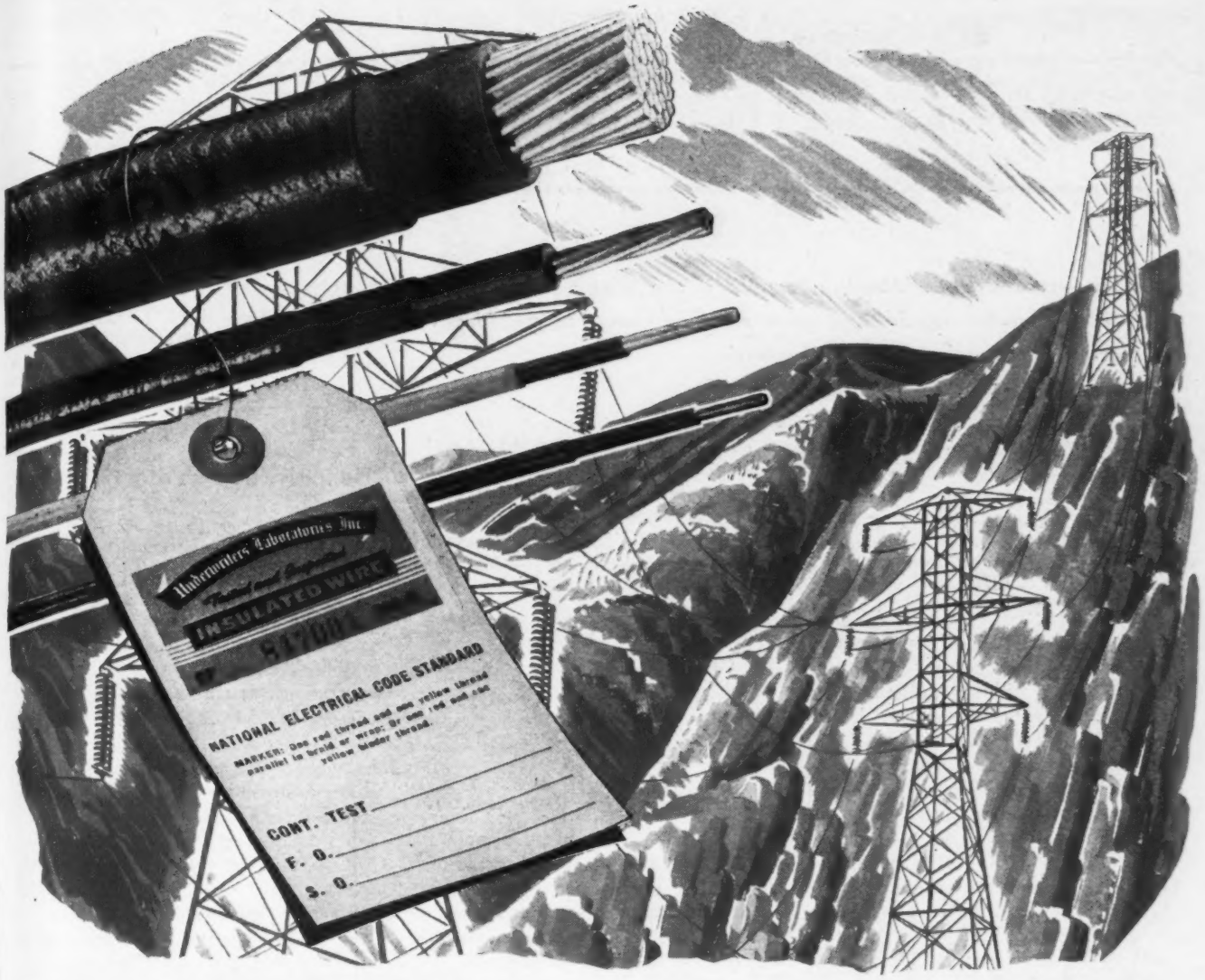
M. L. MONSON
Superintendent
Fosston Municipal Light and Power
Fosston, Minn.



ARRANGEMENT of service when pole is close to house

A METHOD of running service wires from pole to building when the pole is located adjacent to a building is shown in the accompanying sketch.

Arrangement of the equipment not only provides climbing space but makes a neat job. A 3-ft. x 3½-in. x 4½-in. standard crossarm is attached to the pole as a sidearm. The service wires are attached to wire holders which are mounted on the side of the arm and have an 8-in. spacing.



NOW... ALCOA ALUMINUM FOR BUILDING WIRE!

Here's good news for architects, builders, and electrical contractors!

Aluminum Building Wire in sizes No. 12 A.W.G. to 1,000,000 C.M. and larger are now in production. They have the approval of Underwriters' Laboratories, Inc., and meet the requirements of the 1947 National Electrical Code.

Since 1898, Alcoa Aluminum has been in service in high-voltage conductors on this nation's transmission systems. More than 1½ million miles of aluminum electrical cable are in use today in all parts of the country.

On the job, aluminum conductors have proved themselves efficient and dependable for use wherever electricity is conducted.

Aluminum Building Wire, made from Alcoa Aluminum, is now available from manufacturers of insulated wire for use in homes, factories, stores, etc.

See your manufacturer, distributor, or jobber for further information on Aluminum Building Wire. ALUMINUM COMPANY OF AMERICA, 2138 Gulf Bldg., Pittsburgh 19, Pa. Sales offices in leading cities.

MORE people want MORE aluminum for MORE uses than ever

ALCOA FIRST IN ALUMINUM

ALCOA ALUMINUM

IN EVERY COMMERCIAL FORM

DIGESTS

Condensations and abstracts of articles in the foreign press, committee reports, unpublished papers before numerous technical societies, research bulletins, standards

Earthing High-Voltage Systems

From a paper by G. H. Couvreur before the Conférence Internationale des Grands Réseaux Électriques, Paris, June 27-July 6, 1946.

GROUND CONDUCTORS must be designed and installed as carefully as live conductors and must carry considerable current safely without undue heating or dangerous voltage gradients. Defective or insufficient grounds are a real danger to station personnel and others, as well as to the equipment. Ground electrodes in modern installations include (1) plates or grids; (2) buried wires or strips; (3) solid or tubular rods; (4) meshed networks.

As the earth resistance of a plate is inversely proportional to the square root of the surface area it does not sensibly decrease if the plate is larger than 1 m. square. It is better to use several plates in parallel separated by at least 2 to 3 m. Tests on electrodes in ordinary slightly damp soil showed the resistance of galvanized iron plates 1 m. square and 3 mm. thick to be: one plate, 10 ohms; two plates in parallel, 5.6 ohms; eleven plates in parallel, 0.4 ohm.

A galvanized rod of 30 mm. diameter and 3 m. long has a resistance equivalent to a plate 1 m. square. Use of shorter parallel rods is preferable to one long rod.

Soil resistance varies greatly with humidity, salinity of the water, temperature and geological nature. It increases abruptly at temperatures below freezing and also at relative soil humidities of less than 15 percent. It is necessary to guard against water, running or stagnant; the resistivity of certain kinds of water exceeds that of gravel. Relative values of resistance are: clay, 1; humus, 2; sand, 3; gravel, 10; water, more than 10. Degree of compression and size of particles also must be taken into account.

In general, distributed ground electrodes offer greater safety than concentrated ones, and meshed networks which combine wires or strips with rods are best. Interconnection of the grounding systems of the entire installation provides a general earth network of considerable capacity and low resistance.

Regulation of Closed Gas Cycle Plants

From a paper by F. Salzmann (Escher Wyss Engineering Works) before the American Society of Mechanical Engineers, Detroit, June 17-20, 1946.

REGULATION of gas turbines employing a closed cycle as proposed by Ackeret and Keller permits fluctuations in developed output simply by changing the quantity of working medium. Machine efficiencies remain practically unchanged, since pressures at every point in the cycle vary in the same ratio, while temperatures and flow velocities are unaltered. Only the density of the working medium is varied.

Operation of the regulating equipment is fundamentally simple. When the load drops working medium, usually air, must be discharged and when it rises air must be admitted. During the transition, pressures near where the air is admitted or withdrawn will approach the new condition more quickly than at remoter points. Unlike water or steam turbines the power output is not determined by the position of a valve, since changing phenomena take place in the cycle.

In the paper a mathematical treatment is included for determining the variables of the cycle during load changes.

The simplest regulation is one in which a centrifugal governor opens a discharge valve when speed increases, allowing air to flow from the high-pressure part of the cycle to a low-pressure accumulator or to the atmosphere, or with a speed decrease opens an inlet from a high-pressure accumulator at the same point. A further mathematical discussion in the paper indicates the action that occurs. By these calculations the performance of the installation during load changes can be predicted with exactness.

Busbar Zone Protection

From a paper by G. W. B. Mitchell before the Conférence Internationale des Grands Réseaux Électriques, Paris, June 27-July 6, 1946.

EXPERIENCE shows that busbar zone protection is justified on main power station switchboards and in important substations. It may be obtained by (1) comparing the total current entering the busbars with that leaving (current balance); (2) direct detection of insulation breakdown to ground (frame leakage); (3) use of directional discriminating relays. The second method can be used only for earth fault protection, while the first and third also can protect against phase faults.

The current balance method is safest and best for new switchgear installations where current transformers of adequate size can be accommodated, as it gives fast and correct operation against any possible fault. The frame leakage method may appear attractive but it involves insulating from earth all the gear inside the busbar zone.

Use of directional discriminative relays is to be preferred to frame leakage protection and is distinctly useful with existing equipments in which the current transformers are not suitable for the current balance method. The general principle is that when a busbar fault occurs all circuits which can feed fault current must feed it toward the faulty busbar and none can feed away from it. With an external fault at least one circuit must feed away from the busbar.

A busbar fault is extremely rare and in any one substation is not to be expected more than about once in 20 years. Protection must have a high standard of reliability against incorrect tripping, whether from technical defects or human errors during maintenance. Accordingly the protection should contain two independent features, both of which must act before tripping can occur.

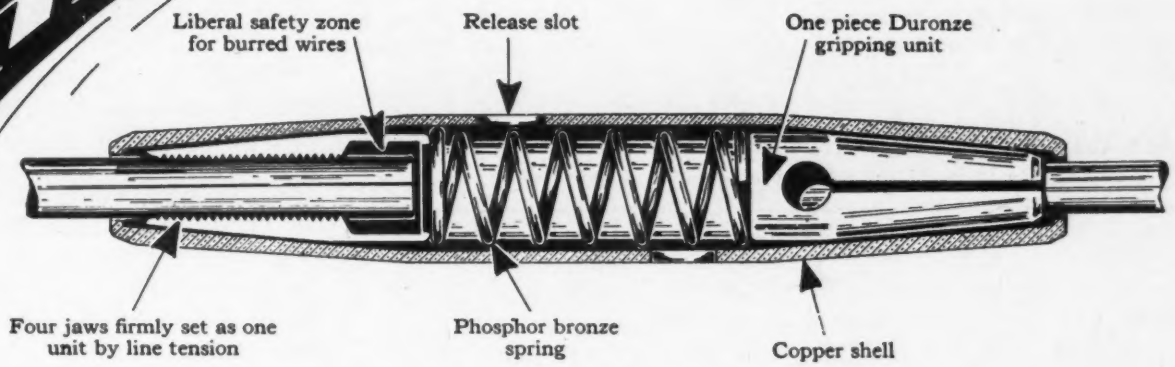
SOME LINEMEN
CALL THEM . . .

"AUTOMATICS"

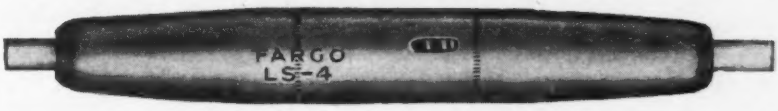
because

they go up

FAST and EASY


Liberal safety zone for burred wires
Release slot
One piece Duronze gripping unit
Four jaws firmly set as one unit by line tension
Phosphor bronze spring
Copper shell

FARGO LINE SPLICES



Available in sizes from #8 to 250,000 CM

ENGINEERS LIKE THEM

1. All parts are equal to or better than copper in "weather-ability."
2. They make a permanently low resistance connection.
3. The connection is as strong as the conductor itself.
4. The over-all cost of an installed Fargo Splice is low

LINEMEN LIKE THEM

1. No extra tools are needed to install them.
2. Safe to use when working in cramped "danger zones."
3. Sag guide helps linemen to properly sag lines.
4. Large safety zone to accommodate burred ends of wire.

ELECTRONS LIKE THEM, TOO

"—the over-all resistance of splice plus contacts is less than the equivalent lengths of conductor—."

FARGO MFG. COMPANY, Inc.
ESTABLISHED 1914
Poughkeepsie, N. Y.

Full Fargo Line Distributed by
LINE MATERIAL COMPANY
Milwaukee, Wisconsin.
(Representatives in principal cities)

LOAD BUILDING

Appliance Market Surveyed Monthly

JOHN H. K. SHANNAHAN
Sales Promotion Supervisor
Indiana Service Corp.
Fort Wayne, Ind.

MONTHLY appliance market surveys are provided by a dealer report plan used by Indiana Service Corp. The appliance dealers of the city are provided with an authentic picture of the appliance business in the locality and the utility has a better knowledge of the market as a guide for promotional efforts and advertising expenditures.

The mechanics of the report are simple. Near the end of each month a form is mailed to each cooperating dealer on which he reports the number of unit sales of each item listed. This is filled out by the dealer and returned without signature and is held confidential by use of a utility envelope for returning the report. Company sales promotion division consolidates the reports and mails to each of the dealers a summary showing the total unit sales of each item on the list.

To the dealer this service offers a picture of the scope of the total market. He knows what his share of the market should be and therefore is given a monthly check-up on his position. It also shows where he may be weak in moving a given item which the report shows in large demand. By increasing his efforts, brushing up on technique, or advertising he may, with little expense, reap the benefits of the public demand.

The dealers are showing an increasing interest in this report which was started in the spring of 1946. It is realized that at present some of the ultimate benefits of the report are not possible because of the market conditions, but the mechanics have been set up and the report is ready to take its place as a valuable informative aid to the dealers and to the utility.

APPLIANCE REPORT FORM—Mailed to dealers each month and returned to utility for consolidated report which is available to all cooperating dealers

CONFIDENTIAL

APPLIANCE DEALERS MONTHLY REPORT OF RETAIL SALES

Month of _____ 194__

INSTRUCTIONS: Report the number of units of each item sold during the period. Leave space blank if item is not sold during period or if not handled. Report of kitchen cabinets, wall and base type, will be made in dollar volume of retail sales. Use enclosed addressed return envelope. DO NOT SIGN THE REPORT.

MAJOR APPLIANCES	No. of Units Sold	MISCELLANEOUS APPLIANCES	No. of Units Sold
Electric Range	_____	Sweepers	_____
Electric Refrigerator	_____	Food Mixers	_____
Electric Water Heater		Electric Blankets	_____
30 gallon	_____	Heating Pads	_____
40 gallon	_____	Room Heaters	_____
50 gallon	_____	Coffee Makers	_____
80 gallon	_____	Grills & Waffle Irons	_____
Larger	_____	Irons	_____
(Tank sizes are nominal)		Electric Roasters	_____
Electric Dishwasher	_____	Broilers	_____
Electric Garbage Disposer	_____	Toasters	_____
Home Freezing Units	_____	Fans	_____
		Hot Plates	_____
LAUNDRY EQUIPMENT		KITCHEN CABINETS	$_____*
Washer (standard)	_____	*Report dollar volume	
Automatic Cycle Type Washer	_____		
Electric Clothes Drier	_____		
Ironer	_____		
RADIO			
Television	_____		
Combination Radio-Phonograph	_____		
Radio (standard)	_____		

Be accurate, be complete, do not fail to send in your report even though you should have nothing to report. The benefits you will get from this report will be proportional to the efforts you make to turn in an accurate report.

This report is due on the 10th of each month. The consolidated report will be mailed to you not later than the 12th.

•

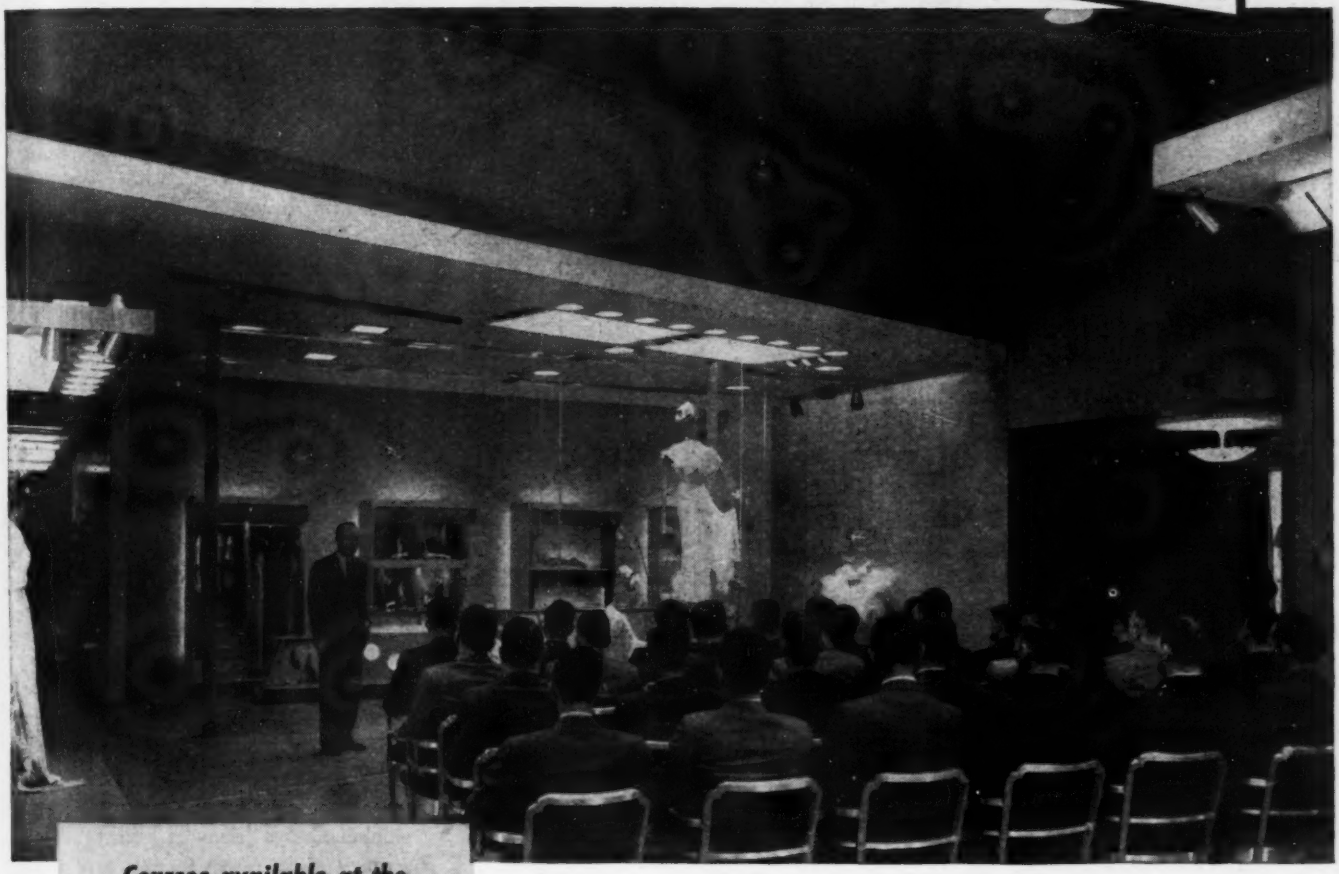
Frozen Foods Research Develops New Load

ON the definitely established basis that freezing of bakery products involves ½ kw.-hr. per pound, Union Electric Co. of Missouri is emphasizing this new development of the frozen foods industry as a potent load-builder.

"As pointed out in the meeting of the Edison Institute in Chicago in April, 1946, frozen baked goods involved a tremendous amount of energy consumption," Robert Coe, sales executive of Union Electric, pointed out. "Therefore, we are encouraging both commercial and do-

Do your lighting men belong in this picture?

G-E LAMP DEPARTMENT OFFERS VALUABLE "PLANNED LIGHTING" COURSES AT NEW INSTITUTE



Courses available at the General Electric Lighting Institute include:

- 5-Day courses in Fundamentals of Commercial and Industrial Lighting and 3-day courses in Home Lighting Fundamentals, giving the basic groundwork for those new at the art.
- 5-Day refresher courses in Advanced Commercial & Industrial Lighting and 3-day advanced courses in Home Lighting, to bring experienced lighting men up to date.
- Special conferences for utility lighting directors, at which street lighting is an important topic.
- Short courses and conferences for groups having special interest in a particular field of lighting—school executives, architects, office building managers, factory managers, merchandising executives.

Contact your G-E Lamp District Office for schedules and detailed information.

● Are you satisfied that the men responsible for your "Planned Lighting" program are up-to-date on the latest lighting techniques? They can gain this valuable information quickly and interestingly at the new General Electric Lighting Institute. Both fundamental and advanced courses are available, presented by a faculty of G-E specialists in all fields of lighting.

We invite utility companies to make arrangements now with any G-E Lamp District Office to send their key men to Nela Park for fresh inspiration and practical instruction on "What's new in lighting."

General Electric Lamp Dept., Nela Park, Cleveland 12, Ohio.

G-E LAMPS

GENERAL ELECTRIC

G-E Automatic Blanket—
Goes on when the lights go off!

The New G-E Automatic Blanket makes even the darkest hours pay off—for you!

Here's a load-builder that goes to work just when you need it most—from *midnight till morning.* More than 200,000 G-E Blankets are now in use—and *every two* equal one six-foot refrigerator in kilowatt-hour consumption.

More good news! G. E.'s exclusive Two-Control Blanket is now available, in addition to the One-Control Blanket. New sleeping comfort for husbands and wives requiring separate degrees of sleep-inducing warmth! It's a big favorite already, and of course it means more off-peak load for you!

For the last two years people have been reading about G-E Blankets. Four-color advertisements have been running regularly in magazines like *Life*, *Good Housekeeping*, *This Week*, and *National Geographic*, with circulations totaling up in the millions.

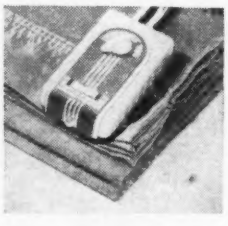
And from coast to coast everybody's talking about this super-cozy way to sleep snugly under one feather-light covering, even on coldest nights.

So, Write Now for complete information. Find out how you can make the most of this time-proved load-builder. Appliance and Merchandise Dept., General Electric Company, Bridgeport 2, Conn.

First in sleeping comfort

Automatic Blanket

Approved by Underwriters' Laboratories, Inc.



GENERAL ELECTRIC

mestic use of frozen baked goods in the St. Louis area."

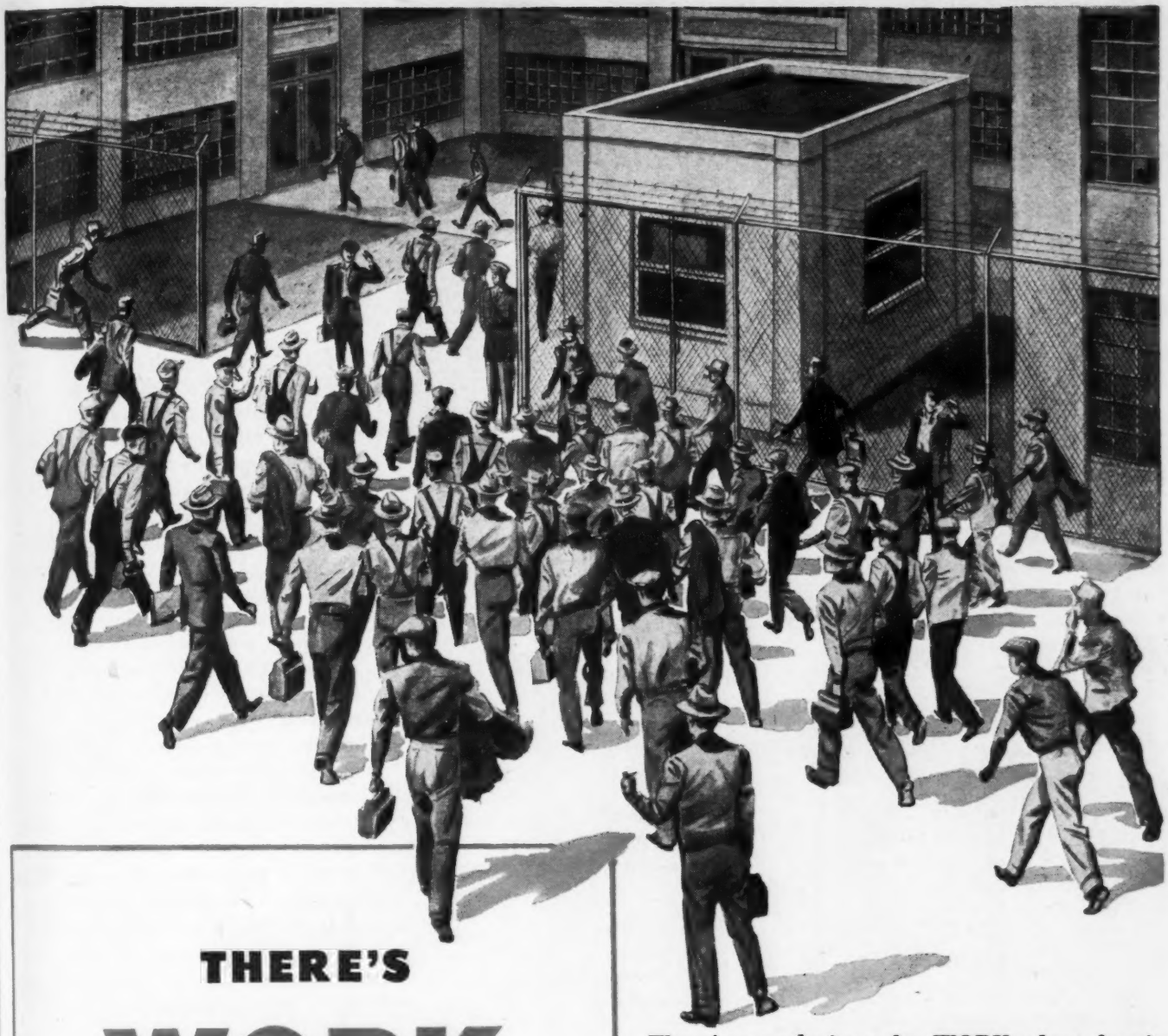
Union Electric Co., through its home economics department, began pioneering research into frozen baked goods three years ago, on a scientific test basis. After freezing and baking scores of pies, which to date are the No. 1 consideration of both bakeries and the home user, Miss Esther Lee Bride, head of the department, has been able to effect a worth-while over-all increase in the use of frozen baked goods in St. Louis homes. Also, a commercial aspect has been given the campaign through encouraging Pfeifer Pastries, a St. Louis bakery, to go into frozen baked goods on a wide scale, and has resulted in steady promotion of frozen pies and other bakery products in Boark Products Co. stores, three of which are now operating in the municipalities of St. Louis and Sedalia, Mo.

Use Own Facilities

All of the work has been carried out in the basement kitchen of Union Electric Co., which has a complete freezing unit for testing, and classrooms for regularly scheduled classes for housewives, economists, club organizations and commercial firms. Averaging four classes a week, the home economics staff of 25 women had spread accurate information on frozen baked products through St. Louis.

"The classes have a definite value because many more women are buying home freezers, renting lockers in commercial low-temperature plants, etc.," it was pointed out. "This, of course, is highly satisfactory load-building and so long as women continue to install home freezers, power usage will be better balanced. However, there is a very real danger in the fact that many women are mishandling frozen foods of all types in home use—applying insufficient temperatures, overtaxing refrigeration capabilities, etc. By developing good methods of quick freezing doughs, we are teaching women how to use quick freezing equipment more efficiently and preventing any loss of confidence in home freezers."

"Of course, load-building advantages derived from this program are indirect," Mr. Coe pointed out, "but each commercial baker whom we encourage to freeze bakery goods leads the way to many more domestic home



THERE'S WORK TO BE DONE!

There's no substitute for WORK when there's work to be done. Benefits of the great technological advances* of recent years can be unleashed only through production that puts them to work. Through mass production *everyone* gains . . . it's the American way to progress, to better living for all. Let's work, like Americans, for there's great work to be done.

**In paper, too, important technological advances have been made. MOSINEE "Paperologists" can help you make the most of modern essential papers in your product. Call for MOSINEE paper technicians!*

MOSINEE PAPER MILLS CO. MOSINEE, WISCONSIN

MOSINEE PAPER MILLS COMPANY

MOSINEE • WISCONSIN

Essential Paper Makers

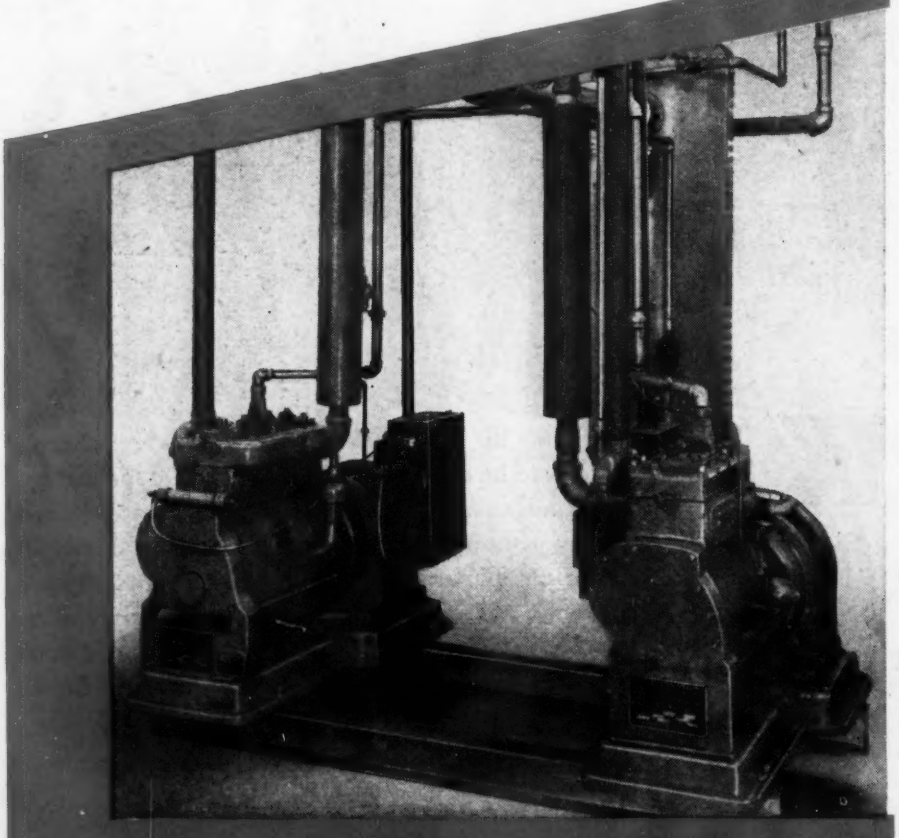
Please address your letter "Attention Dept. B"

Why Industry Uses Schramm Air Compressors

There are many compressed air jobs to be done in Industry, and into this versatile picture fits the Schramm Air Compressor. Either portable or stationary, Schramm enables compressed air jobs to be done quickly—easily—economically!

Schramm Compressors are better because they are 100 per cent watercooled . . . compact and lightweight . . . have mechanical intake valve and forced feed lubrication!

Schramms come in a variety of sizes. So whatever your need for compressed air . . . there's a Schramm to do the job. Write today for illustrated booklets and plan to use a Schramm in the New Era now facing Industry!



SCHRAMM INC.

THE COMPRESSOR PEOPLE

WEST CHESTER, PENNSYLVANIA

freezer users, many of whom will use electrical service both in freezing, thawing and later baking of the pie. Therefore, we are continuing to put much emphasis on correct handling, preparation, and baking of pies."

•

Denverites Like Mercury Street Lighting

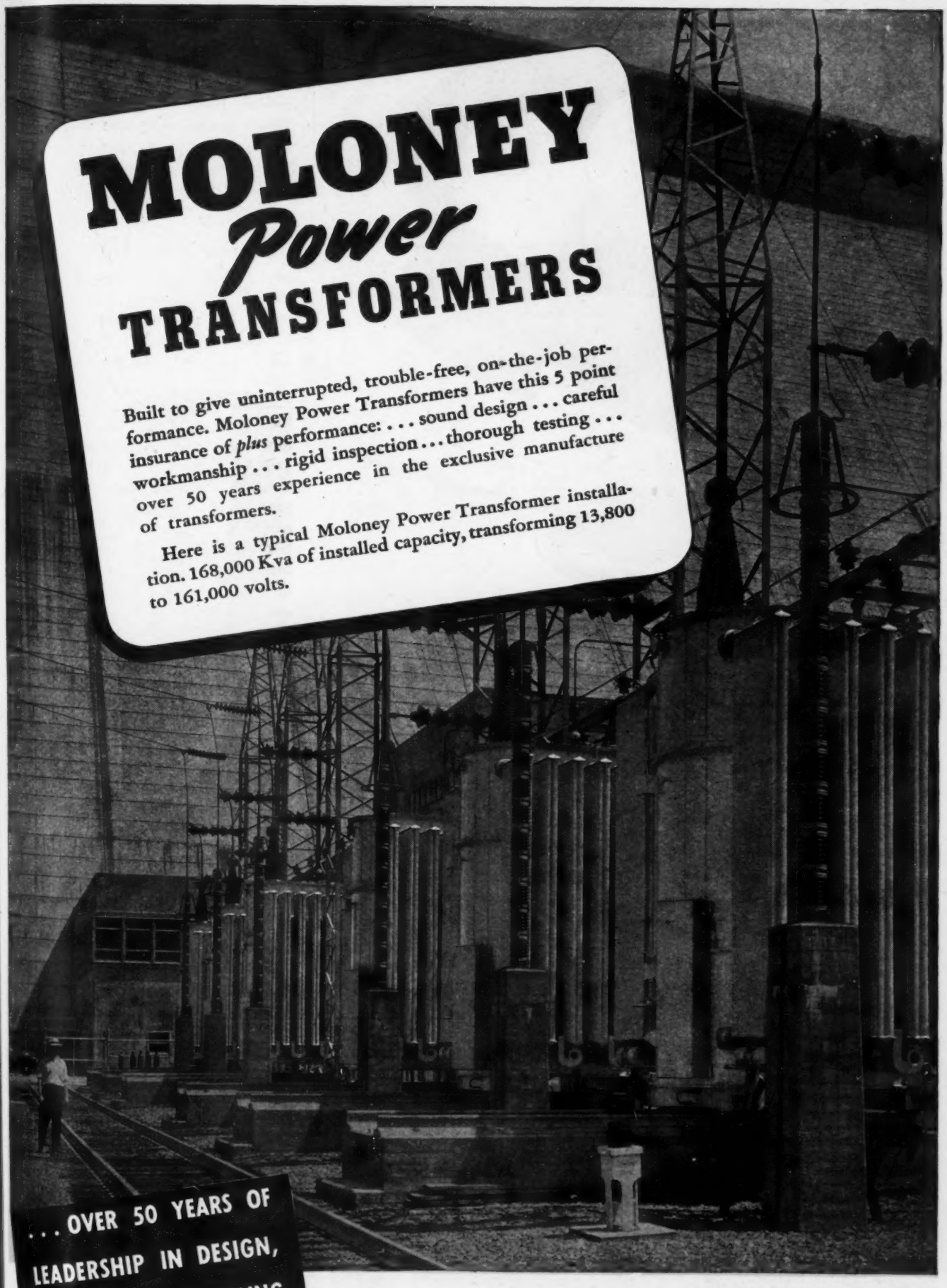
REACTION of merchants, cab drivers and the general public to Denver's mercury street lighting proved most interesting to two lighting specialists of Portland (Ore.) General Electric Co., who recently made an extensive lighting inspection tour.

Merchants interviewed stated that their own window lighting overcame any possible objection to the bluish-green cast of the mercury vapor street lights. This expression, coming from such stores as floral shops and art exhibitors, was particularly conclusive because of their critical attitude toward the color quality of the light in their display windows. Many merchants were not even conscious of the fact that there were any color considerations involved. This seemed to prove that any worries in connection with the color value of mercury street lighting were unfounded. This lack of criticism was only logical, after all, when it is considered that the intensity of any display lighting is many times the possible infiltration of the bluish-green cast of the street lighting.

Public Reaction Good

Comments of the "man on the street" were sought. Several drivers for Denver's largest cab company were interviewed. It was rather surprising to find that they were fully conscious of the difference in types of street lighting. All were quite enthusiastic over the mercury lights. They said that there was something about the light that made pedestrians much easier to see. Also, they especially mentioned the comparative lack of glare, and that the light was less tiring on their eyes. Others talked to concurred, as did also the two lighting men, Theron W. Fitch and Chester W. Jarrett, after being driven around the city on an inspection tour.

The two left Denver well satisfied that the color value of mercury vapor is not a factor in street lighting and



MOLONEY *Power* TRANSFORMERS

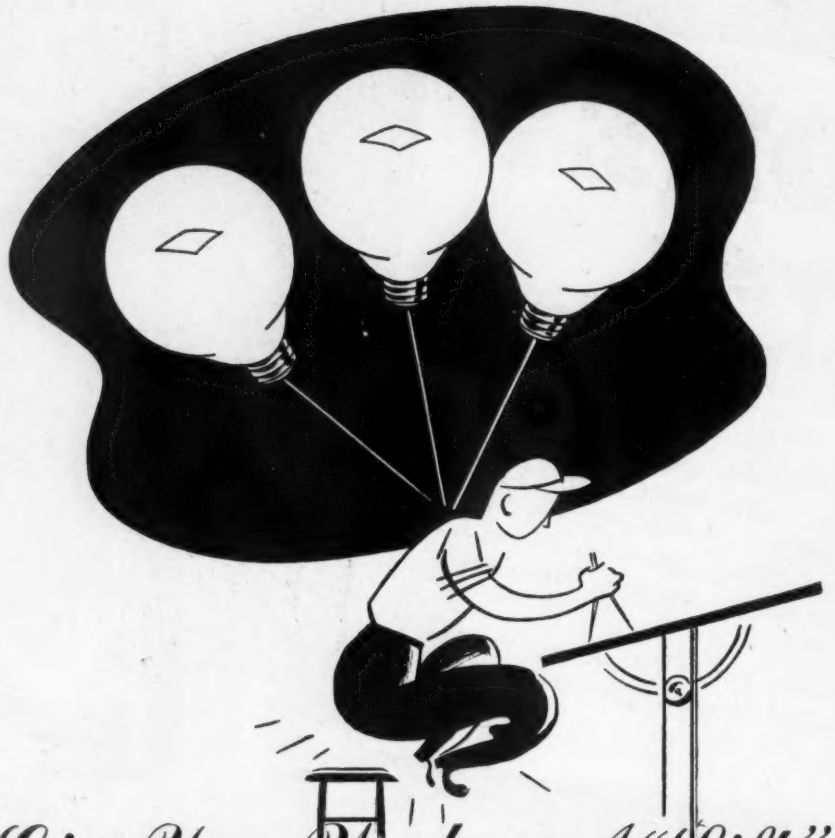
Built to give uninterrupted, trouble-free, on-the-job performance. Moloney Power Transformers have this 5 point insurance of *plus* performance: . . . sound design . . . careful workmanship . . . rigid inspection . . . thorough testing . . . over 50 years experience in the exclusive manufacture of transformers.

Here is a typical Moloney Power Transformer installation. 168,000 Kva of installed capacity, transforming 13,800 to 161,000 volts.

. . . OVER 50 YEARS OF LEADERSHIP IN DESIGN, RESEARCH, ENGINEERING

MOLONEY ELECTRIC CO. ★ ST. LOUIS 20, MO.

POWER AND DISTRIBUTION TRANSFORMERS EXCLUSIVELY SINCE 1896



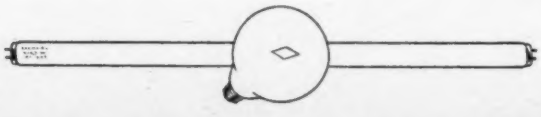
Give Your Workers A "Lift"
with **CHAMPION**

Fluorescent and Incandescent Lamps

Reduced eyestrain, conserved nervous energy, sharply diminished accident hazards, infinitely pleasanter working conditions and improved morale — all are the result of good lamps and lighting.

Champion makes the lamps, specially for industrial service, and provides a consulting service on lighting engineering *without charge or obligation.*

Champion industrial distributors are ready to supply your lamp needs with the utmost efficiency at lowest cost, lighting effectiveness and lamp performance considered.



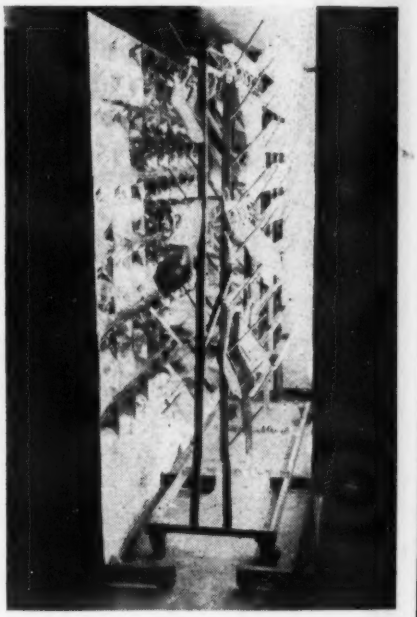
CHAMPION LAMP WORKS
Lynn, Massachusetts
A DIVISION OF CONSOLIDATED ELECTRIC LAMP CO

that they could conscientiously recommend it in their own territory. Approximately half of the city of Denver's arterial highways are now mercury lighted and the city has underway a comprehensive program to extend the mercury vapor street lighting it has had for several years.

•

Infrared Steps Up Awning Production

F. W. OGDEN
Savannah Electric & Power Co.,
Savannah, Ga.



SLATS and louvers for metal awnings are finished quickly by infrared

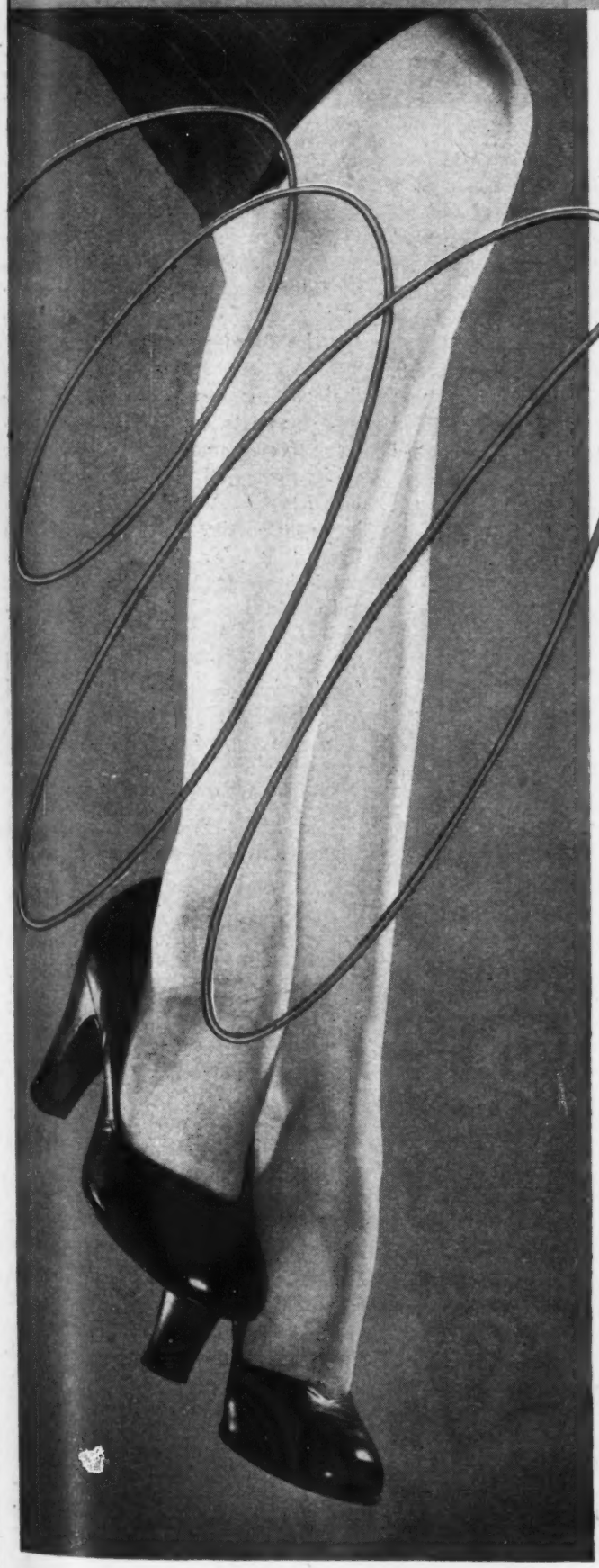
FROM 48 to 96 hours were required to air-dry the spray-painted slats and louvers of metal awnings manufactured by the Koolvent Awning Co. of Savannah, Ga. The drying operation took up 1,500 sq. ft. of floor space and each piece had to be handled four times.

Now drying time for the parts is 9 to 11 minutes, most of the floor space has been released for other operations, and only three handlings are necessary.

This remarkable improvement in production was accomplished by two banks of 375-watt infrared lamps, each bank containing 60 lamps, six high and ten long, and by changing from paint to a bake-type enamel. Additional to the increase in production rate, the product is improved in quality by its baked enamel finish.

UNITED STATES RUBBER COMPANY

SERVING THROUGH SCIENCE



a modern new wire

This new building wire, in the branch circuit sizes, is finished in nylon and is called "Neolay."

It's the smallest diameter, lightest weight building wire on the market. The nylon-smooth finish and small diameter facilitate installation.

Laminated walls of Laytex (90 per cent pure rubber) insulation give high dielectric strength. On top of the Laytex is a layer of flame retardant Neoprene.

The larger sizes—No. 6 AWG to 1,000,000 CM—are supplied with an aluminum conductor, RH insulation and a Neoprene jacket. This construction provides a cable that is unusually tough and strong, and exceedingly light.

Investigate! Write United States Rubber Company, Wire and Cable Department, 1230 Avenue of the Americas, New York 20, N. Y.

Reg. U. S. Pat. Off.

ELECTRICAL WIRES & CABLES

UNITED STATES RUBBER COMPANY · US · TRADE MARK

(*Continued from page 105*)

capital item, and such of it as might be re-invested in power would also have to be repaid.

7. No more direct appropriations should be made for dams, reservoirs and other power facilities not provided under Sections 12 and 26 of the Act. This complements Recommendation No. 2.

Promotes Flexibility

8. TVA should be permitted to use unappropriated funds or its borrowing power to finance extensions to its existing commercial facilities which are deemed necessary to contract fulfilment. Thereafter, it would have to come to Congress for funds to replace those so spent. This would provide ample financial flexibility for normal operating requirements. For capital to extend its basic system, i.e., a new dam or steam plant, it would have to go to Congress, before construction, for authorization and appropriation of the necessary capital subscription. This would bolster Congressional control of capital investments without crippling routine operating procedures. Presently, under TVA's interpretation of Section 26, it may extend its existing system, and could add to its basic system without specific Congressional appropriation, the report indicates.

9. Separate appropriations should be made for operating expenses of TVA's navigation, flood control and other essentially or entirely non-revenue-producing developmental programs. TVA now has one appropriation for all purposes. This provision would establish, in effect, a "spending budget" and an "investment budget." It would mitigate the effect of one of the broadest grants of authority ever made for a non-war program—that which permits TVA to do almost anything, without challenge by the General Accounting Office, which its directors find to be necessary to effectuate the purposes of the Act.

10. TVA should be permitted to keep all its funds in one depositary account. This would simplify cash accounting without removing any necessary accounting protection.

11. TVA should not be required to render accounts to the General Accounting Office. The Government Corporations Control Act will afford full protection of Congressional prerogatives while simplifying TVA's accounting.

Costs Held Incomplete

The audit-report notes that no depreciation is accrued on costs of land rights, clearing for transmission lines and reservoirs, or removing and relocating inhabitants. It concedes that the Federal Power Commission does not require this, but suggests that FPC study the question. The report agrees with TVA's selection of 100 years as the reasonable service life of certain facilities, and asserts that if the $123,000,000 invested in land rights and costs were depreciated over the full service life, annual depreciation accruals would be boosted by $1,232,000,000, of which perhaps $500,000 would be applicable to power operations.

Commenting upon taxes, the report noted that "TVA contributes to the support of state and local governments in its area through payments in lieu of property taxes, but, like other federal agencies and other governmentally owned public utilities, it is not required by law to make any contribution to the general support of the federal government through the payment of income taxes."

Some will argue, no doubt, that the report weakened itself by failing to recommend that such income taxes be paid. Why this was not done is a matter of conjecture, but since the act specifically exempts TVA from such payments, it may be assumed that GAO did not consider it proper to suggest a specific revision of national policy to Congress.

The report specifically recommended that TVA pay interest upon all its investment in power facilities. This recommendation more than any other, perhaps, will draw the most severe fire from TVA supporters. The report noted that interest paid and charged to power "is limited to the interest on its bonds held by the Treasury and the Reconstruction Finance Corporation ($61,072,500 outstanding June 30, 1945.)" On $56,500,000 of this, the report added, TVA pays, by temporary agreement with the Treasury, only 1 percent interest. Presently, it adds, the Treasury pays 2.5 percent for long-term borrowings. No interest is required by law on the remainder of TVA's capital power investment of approximately $400,000,000. Based on the long-term interest rate and the power investment, the report continues, "the annual interest cost to the United States Government on its investment in power facilities would be $10,000,000, or approximately $9,274,000 in excess of interest charged in the income statement for power operations for the fiscal year 1945."

TVA's accounting fails to show real cost in two other regards, the report asserts. One of these, "contrary to customary practice in public utility accounting," is interest on property, plant and equipment during construction. Payment of such interest, it adds, would increase depreciation accruals for these items.

In addition, TVA does not pay claims for injuries or damages suffered by employees. These are paid for by appropriation. If TVA did pay them, its annual depreciation accruals would show some increase.

Cost Recommendations

The audit-report recommended that Congress consider specific amendment of the TVA act.

"1. All claims for injuries and damages should be paid by TVA and not charged to separate appropriations from the United States Treasury for the United States Employees Compensation Commission unless such charges are reimbursed to it by TVA.

"2. Interest should be required to be paid to the Treasury on the entire investment of the government in power operations.

"3. Retroactive adjustments should be required as to both interest and claims for injuries and damages, to the end that TVA shall reflect in its accounts such costs for prior years as additional capital invested by the United States Government. It is understood that that portion applicable to construction would be added to the cost of property, plant and equipment and made the subject of annual depreciation charges."

Made to SELL . . . with CHROMEL*

. . . the *Original* Nickel-Chromium Heating Element Wire

Chromel
NICKEL | CHROMIUM WIRE

*TRADEMARK REG. U. S. PAT. OFF.

YES, durable Hoskins CHROMEL resistor wire carries the heating load in modern, effortless ironers. In every other type of electrical heating device, too, for that matter. For CHROMEL, as you know, is the Nickel-Chromium resistor wire that first made electrical heating practical. It gets hot and it stays hot for a long, long time.

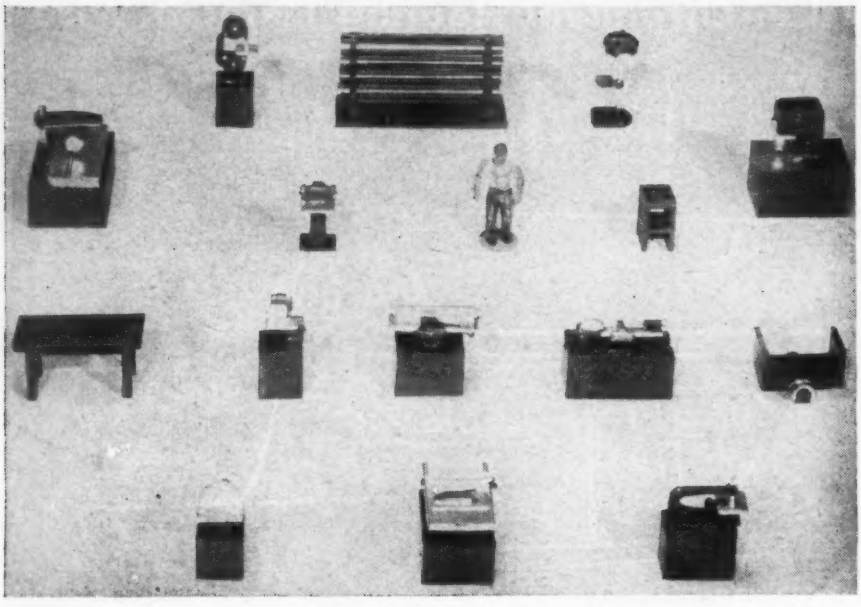
There's ample proof of CHROMEL'S dependable outstanding durability, too. Proof in the fact that, despite endless research, no basic changes have been made in CHROMEL'S original formula. Further proof in the fact that, since its discovery over forty years ago, CHROMEL has been consistently specified with complete confidence by the most exacting producers of top line products.

Our Catalog-M1 is loaded with helpful technical data on the CHROMEL Alloys and their application . . . information of interest to your Load Building Department. Want a reference copy?

HOSKINS MANUFACTURING COMPANY • Detroit 8, Michigan

NEW EQUIPMENT

Machine Models Assist Utility Power Salesmen



A COMPLETE LINE of wood-working equipment in ¼-in. scale to implement the company's line of 3-dimensional template-base machine-tool models and office equipment has been announced by Visual Production Planning Incorporated, 5102 Butler St., Pittsburgh 1, Pa. These models were developed to facilitate plant layout by production engineers and power salesmen.

•

Transformer Compensates for 30 Percent Drop

A NEW constant voltage transformer, designed to compensate for a 30 percent drop in the circuit, has been announced by Sola Electric Co., 2525 Clybourn Ave., Chicago 4, Ill. It was designed primarily to supply regulated voltage to domestic refrigerators and freezer units having a ⅕-hp. (or less) compressor motor.

The manufacturer reports it is designed with sufficient capacity to "pull down" a 115-volt, ⅕-hp. motor-compressor unit from a temperature of 104 deg. F. with a line voltage of 85 volts. After the initial pull-down period, safe operation is reported on potentials as low as 70 volts.

The new transformer is identical to the company's standard voltage regulating transformer except for the incorporation of a relay which operates for a fraction of a second during each starting cycle. This new circuit arrangement prevents the current limiting characteristics of the transformer from being effective until the motor has reached its normal operating speed, it is stated.

Company also reports that it makes possible the small dimensions (12⅝ x 5⅝ x 5 in.) which allow the unit to be installed in the motor compartment. The company states the transformer will prevent stalled compressors, overheated motors, and burned-out windings due to abnormal voltage conditions.

•

Pressure-Time Investigations Advanced by New Device

A NEW electronic device, called the Syncro-Marker, designed to transmit a picture of pressure variations related to time and speed indicators to the screen of a cathode ray oscillograph, has been announced by Electro Products Laboratories, 549 West Randolph St., Chicago 6, Ill. The new device can be used in making pressure-time investigations on internal combustion engines, compressors, pumps, fuel studies and displacement of moving parts.

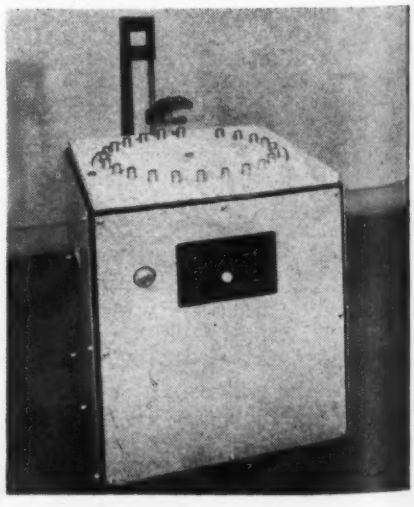
•

Indexing Table Simplifies HF Heat Operations

A NEW indexing table, usable in soldering, brazing, and annealing of round or irregularly-shaped small parts, has been developed by Lepel High Frequency Laboratories, Inc., 39 West 60th St., New York 23, N. Y. The manufacturer reports the unit was developed for use where control of heat requires close or accurate coupling.

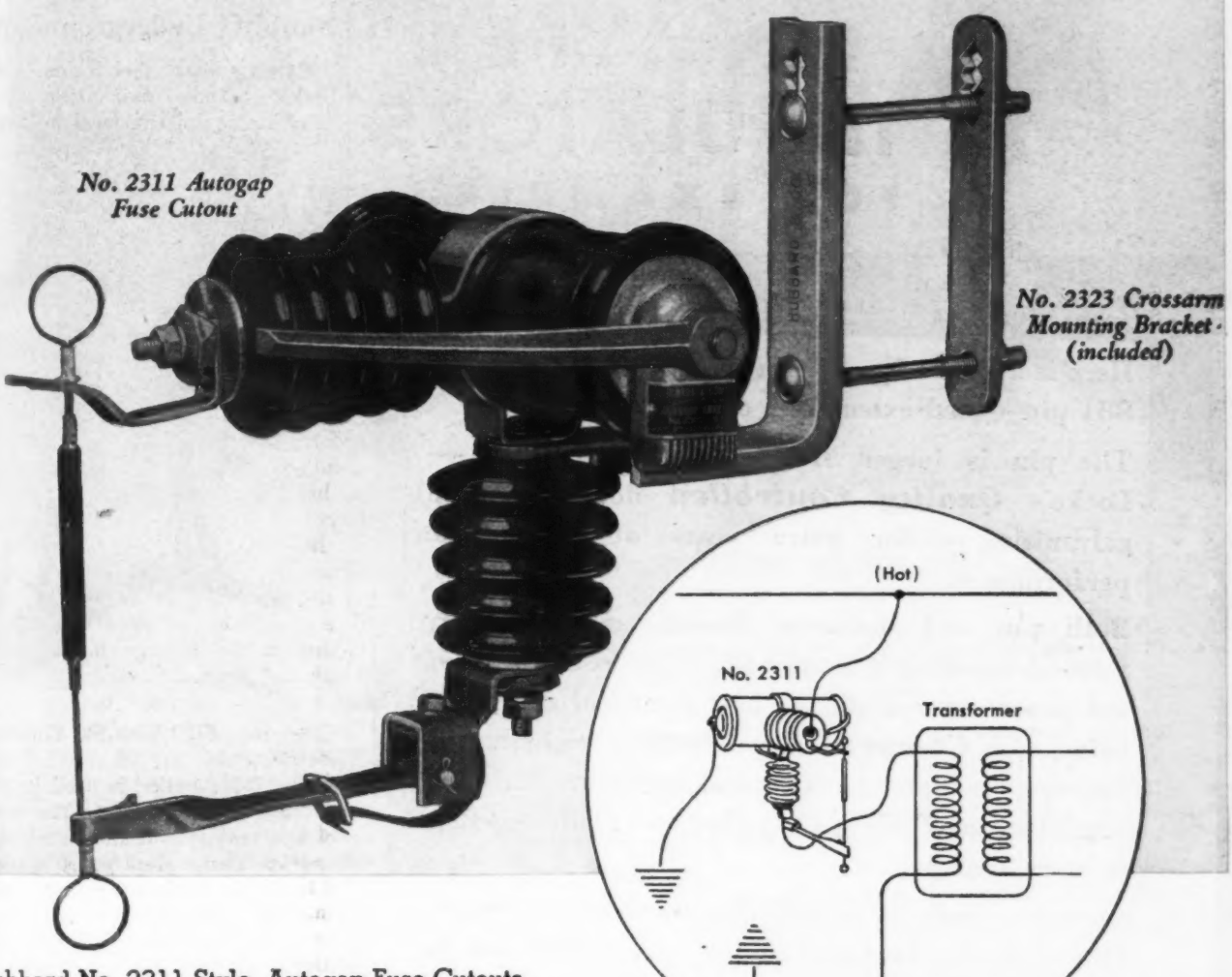
Parts on the table are moved or indexed into heating position, the load coil lowers to surround the part, and the heating cycle is carried out automatically. Length of the heating cycle can be varied to meet any requirements by an adjustable timer, and the index speed adjusted by changes in the variable speed drive. Upward and downward travel of the load coil is normally 3½ in., but can be adjusted.

The new table can be used in conjunction with any of the company's high-frequency converters or other high-frequency generator, and comes equipped with a built-in automatic timer which controls the heating time.



HUBBARD AUTOGAP FUSE

A combination of the No. 2302 Hubbard Autogap Arrester with a 7½ K.V. dropout Fuse



Hubbard No. 2311 Style, Autogap Fuse Cutouts are recommended for use when phase to ground voltage does not exceed 7500 volts. Fuse rating is 50 Amperes and interrupting capacity is 1200 Amperes. Bracket No. 2323 is furnished for cross arm mounting and No. 2325 for pole mounting. Type of Bracket must be specified when ordering as one type only is included. Special brackets can be furnished. Fuse links are not included.

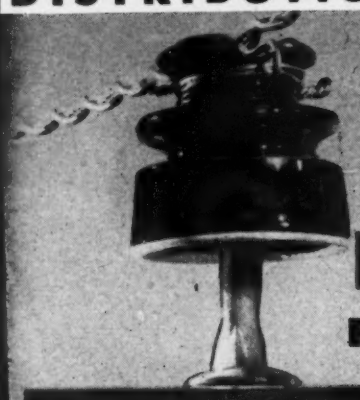
This new Hubbard open link type of cut-out is built around the sturdy and efficient Autogap No. 2302 with the fuse mechanism added. It has the same highly rated moisture proof, long-life Autogap qualifications that are so widely accepted by engineers throughout the power field. It is approved by R.E.A. and will be displayed at Hubbard Booth No. 8 at the National Rural Electric Cooperative Association Convention at Spokane, April 22-25. Ask to see it and don't miss the miniature Hubbard Autogap in action.

HUBBARD and COMPANY

Pittsburgh *Chicago*

Oakland, California

LOOK TO LOCKE FOR
DISTRIBUTION MATERIALS...



PINS *and*
PIN TYPE
INSULATORS
FOR EXAMPLE...

Here is a Locke No. 77 pin type insulator on a No. 881 pin—used extensively on distribution lines.

The pin is forged steel, with ***Permazinc*** — Locke's ***Quality Controlled*** double hot-dip galvanizing — for extra years of dependable performance.

Both pin and insulator threads are accurately formed, assuring a proper fit. The insulator is of wet process porcelain for best electrical characteristics, with ***Compression Glaze***—originated by Locke—for highest mechanical strength. Pins and insulators are designed together and made together to work together.

Complete lines of distribution materials are maintained in six Locke regional warehouses and in most distributors' stocks. Call in your Locke representative.

Depend on Locke for Quality Controlled distribution materials—pole line hardware and insulators. One order covers both.

Locke POLE LINE HARDWARE *and* INSULATORS

LOCKE INSULATOR CORPORATION • BALTIMORE 3, MD.

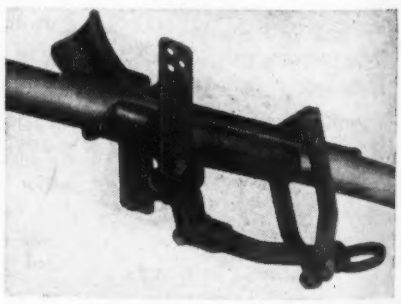
This timer also controls the power of the converter, turning it on and off simultaneously with the downward and upward stroke of the load coil.

•

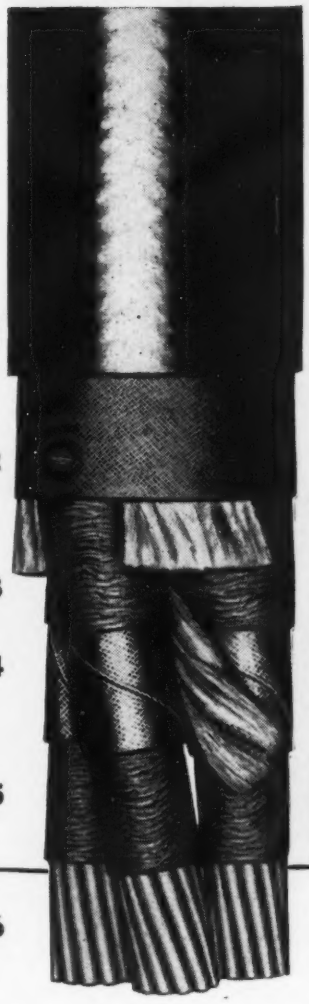
Three New Developments Simplify Underground Work

CABLE PULLER, reel turner, and reel brake are three new pieces of cable handling equipment developed by T. J. Cope, Inc., 6120 Vine St., Philadelphia 39, Pa.

The cable puller is used in pulling out 2½- to 3-in. cable. The grips or clamps are made of alloy steel castings and are designed to exert a pressure grip on the cable when in the pulling position. Slackening of the winch or hoist releases the grip and the tool is slid back on the cable for another pull. The manufacturer reports that the grip will not cut or deform the cable.



The reel turner is adjustable to any standard size reel. It is stated that one man can safely turn the reel and take up the cable as it is pulled from the conduit. The reel brake is likewise adjustable to various size reels. Rings are provided on the base plate for fastening it to the jack. The weight of the jack and the reels prevent the



When You Do a Little Cool Calculating on your costs for HOT-SPOT WIRING

Hot-spot circuits are usually out of sight, but seldom out of mind—unless you have taken the precaution to install Rockbestos A.V.C.

If you total up the expense of maintaining these trouble-makers you're bound to come to the conclusion that the initial cost of cable has little bearing on *true* cost. And it follows that a cable which will protect operations and reduce maintenance is more economical in the long run.

Judged on the above basis Rockbestos A.V.C. wires and cables give you *plus* values. Heat can't shorten their lives because they are *permanently insulated* with impregnated asbestos to give *continuous* service under 230°F. temperature. They are highly resistant to corrosive fumes, moisture, oil, grease and oxidation. And their greater current carrying capacity provides an additional safety factor.

Made in power, control and lighting constructions—in voltage ratings of 600 to 5000—including National Electrical Code types. Send for a catalog.

A PERMANENT ROCKBESTOS CONSTRUCTION THAT ASSURES LONG-LIVED SERVICE

The Rockbestos A.V.C. 600 Volt Power Cable illustrated has each conductor insulated exactly like single conductor Power and Motor Lead Cables (maximum operating temperature 110°C.). Also made with lead sheath or armor and in higher voltages.

1 A tough impregnated asbestos yarn braid, resistant to heat, flame, moisture, oil, grease and fumes.

2 Tape binds jute fillers (asbestos if required) and cabled assembly securely.

3 Heat, flame and moisture resistant impregnated felted asbestos insulation that won't dry out, crack or rot.

4 Asbestos-protected varnished cambric for high dielectric strength and added moisture resistance.

5 Inner wall of impregnated felted asbestos withstands conductor-heating overloads and won't bake brittle or burn.

6 Conductors are perfectly and permanently centered in helically applied non-flowing insulation that provides greater current carrying capacity.

One of 125 different constructions designed by Rockbestos for severe or unusual operating conditions.

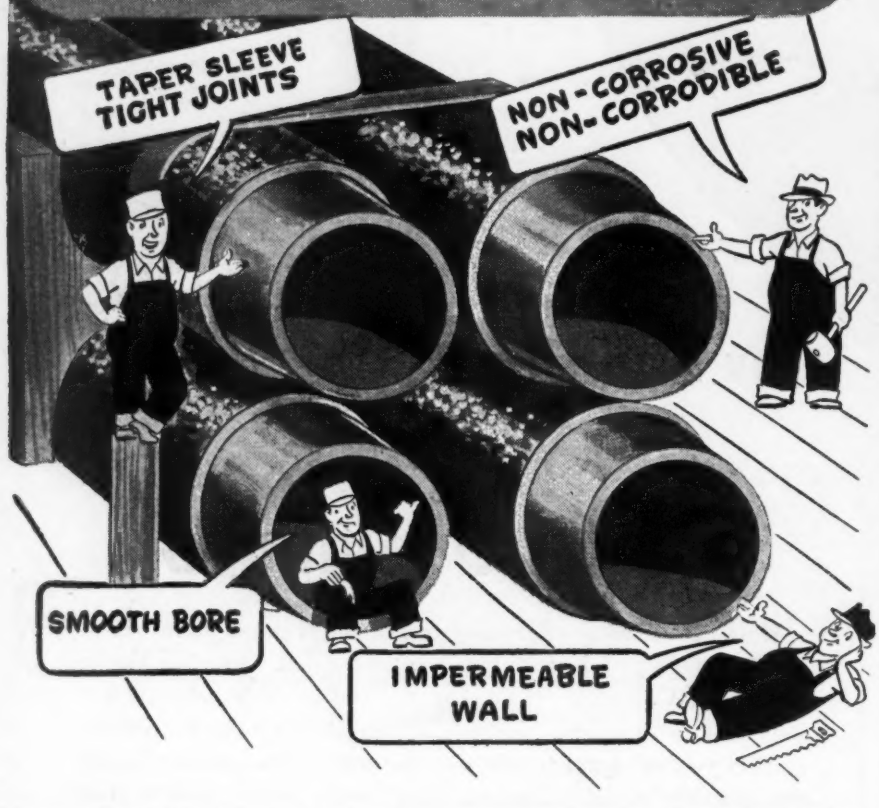
Rockbestos Products Corporation
209 Nicoll Street, New Haven 4, Conn.

ROCKBESTOS A.V.C.

The Wire with Permanent Insulation

NEW YORK BUFFALO CLEVELAND PITTSBURGH DETROIT CHICAGO ST. LOUIS LOS ANGELES SAN FRANCISCO SEATTLE PORTLAND, ORE.

FEATURES TO LOOK FOR IN A BETTER CONDUIT



SMOOTH BORE. ORANGEBURG* CONDUIT provides the important advantages of exceptionally smooth surface and non-abrasive material. *Result*—no scoring or abrasion of sheath when entering the duct—or as the cable creeps under load variations. Also less friction while cables are pulled into ducts — tension is kept low, preventing harmful strains, making longer pulls possible.

TAPERSLEEVE JOINTS—IMPERMEABLE WALLS. These features of ORANGEBURG CONDUIT prevent infiltration of ground water or corrosive elements.

NON-CORROSIVE, NON-CORRODIBLE. ORANGEBURG materials contain nothing to injure cable sheath, and are themselves highly resistant to the action of ground waters and industrial wastes. Write today for FREE copy of interesting, fully informative ORANGEBURG catalog.

THE FIBRE CONDUIT COMPANY • ORANGEBURG, N. Y.

Graybar Electric Co., Inc. • *Distributors* • General Electric Supply Corp.

ORANGEBURG FIBRE CONDUIT

*Reg. U.S. Pat. Off.

ORANGEBURG

WITH 50 YEARS EXPERIENCE IN THE MANUFACTURE OF NON-METALLIC CONDUIT AND PIPE, SERVES THE POWER AND LIGHT, TELEPHONE, GENERAL CONSTRUCTION, CHEMICAL, PETROLEUM, PLUMBING AND BUILDING SUPPLY FIELDS WITH ELECTRICAL FIBRE CONDUIT . . . ELECTRICAL UNDERFLOOR DUCT SYSTEMS . . . AND FIBRE PIPE FOR NON-PRESSURE USES.

brake from slipping. The manufacturer reports that the combined use of reel turner and reel brake makes cable reeling a one-man operation.

•

Electrical Incinerator Developed for Kitchens

A NEW electrically operated portable incinerator, known as the Hygeator, has been developed by Hygeator Corp., Buffalo, N. Y. The appliance, operated

on a patented down-draft principle, has a capacity of 2 bu. and is stated to be completely odorless.

It is 20 in. square and 32 in. high and is recommended for installation in kitchens, basements or service rooms. The appliance is finished in red or white enamel. It has been through the testing stage and is expected to be in the hands of distributors within 60 days.

•

Single Indicator Covers 100 Thermocouples

A NEW high-speed indicator to assist in logging thermocouple temperatures has been developed by Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia 44, Pa. Switching arrangements to meet the needs of practically any application are available with a single unit handling more than 100 thermocouples, the company reports.

To read a temperature, the operator flips a key switch marked for the desired thermocouple, the instrument's drum scale spins and comes to rest at the temperature to be measured.

Heart of the indicator's high-speed balancing mechanism is an amplifier unit which uses standard vacuum tubes. The unit, called Speedomax Indicator, uses the same strip charts as other of

FOR THE NEW SOLID ALUMINUM SERVICE WIRE

Available for Prompt Delivery!

BLACKBURN *Hi-Strength* CONNECTORS

HOW TO ORDER:

See your Local Jobber and Specify these Catalog Numbers:

Max. Copper Line Wire	Max. Alum. Tap Wire	Blackburn Catalog No
6 Solid	6 Solid	6H-3-W
4 Solid	4 "	4H-3-W
2 Solid	2 "	2H-W
2 Stranded	2 "	1H-W
1/o "	2 "	1/oH-W
2/o "	2 "	2/oH-W
4/o "	2 "	4/oH-W

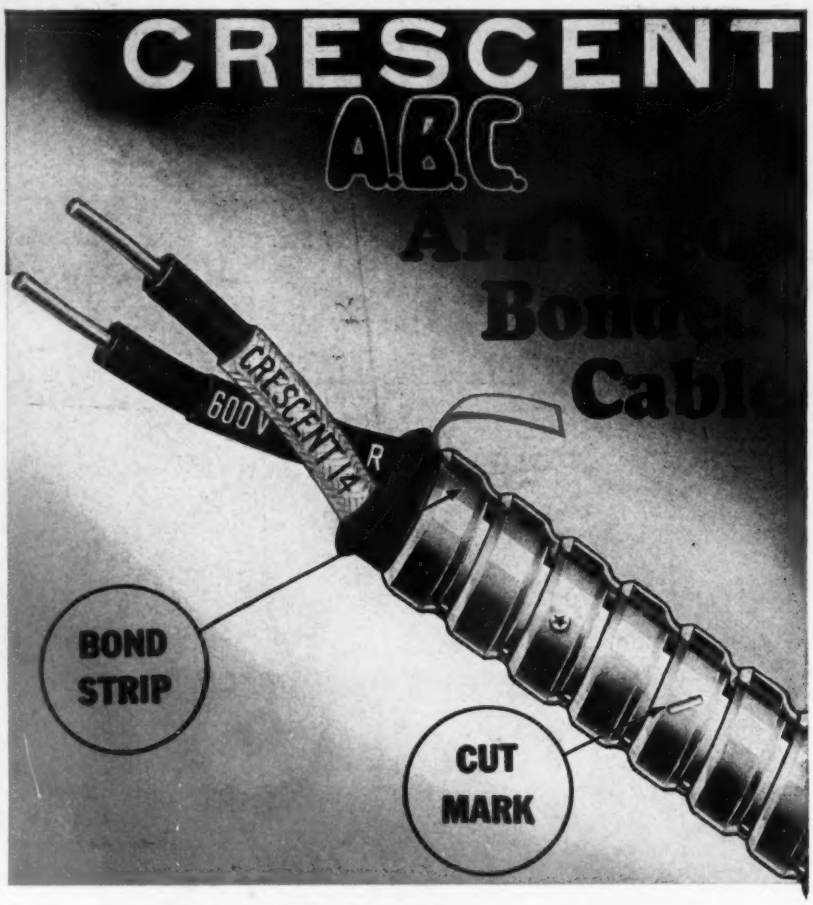
OVER 100 CONVENIENTLY-LOCATED JOBBERS

These New Connectors are Better Because:

1. Aluminum tap is encased between two aluminum-copper, bi-metallic, grooved washers *to prevent electrolysis.*
2. Connectors are designed for use at both the line end and the house end of the aluminum service wires.
3. Connectors can be re-used if the aluminum service wire is ever replaced with a copper wire, by merely removing the two bi-metallic washers.
4. Connectors are made of high strength DURONZE—hence are more durable and last longer.
5. They are truly Hi-Strength Connectors and can be installed very tightly without distorting—hence a more efficient connection.

FIRST, MADISON & CLINTON STS. • **JASPER BLACKBURN PRODUCTS CORP.** • ST. LOUIS 6, MISSOURI

BUILDERS OF QUALITY CONNECTORS FOR OVER 10 YEARS



Has Two Outstanding Advantages

1. BOND STRIP UNDER ARMOR

Permanently low armor resistance is provided in sizes No. 14 and 12 AWG by use of a flattened, tinned copper bonding wire which is in contact with the under side of each convolution. These sizes now are smaller and lighter, since they use the smaller diameter Type R conductors of the 1947 National Electrical Code.

2. PREFABRICATED BREAKING LINES

The Cut Mark (at 1½" intervals) shows the location of a prefabricated breaking line inside the armor. Only a few strokes of a file guided by the Cut Mark are required to cut through one outer ridge, and a bend by hand severs the armor. This results in a clean separation with no sharp edge—a safer, easier and faster job. The prefabricated breaking lines are so designed that there is *no reduction* in tensile strength, bending quality, crushing resistance and electrical conductivity of armor.

CRESCENT
WIRE and CABLE

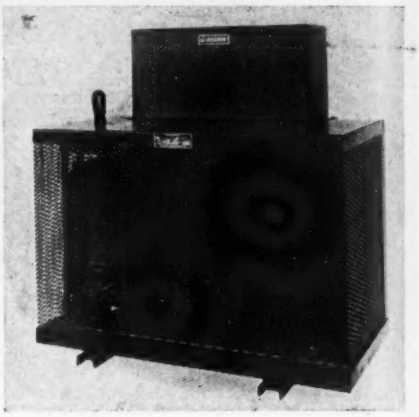
CRESCENT INSULATED WIRE & CABLE CO.
TRENTON, N. J.

the company's instruments. All commonly used ranges for industrial thermocouples can be supplied.

•

Dry Type Transformer Line Developed by Lindberg

A COMPLETE LINE of air-cooled transformers has been announced by Lindberg Engineering Co., 2444 West Hubbard St., Chicago 12, Ill. They are obtainable in ratings from 1 to 100 kva.;



up to 600 volts; single, three or three to two phase. Illustrated is a 50-kva. unit.

The transformers were developed for use with electric furnaces, for testing functions, and various other applications requiring heavy current. They feature a built-in wiring compartment and terminal board. Tap switches to handle up to 500 amp. are available for all transformers.

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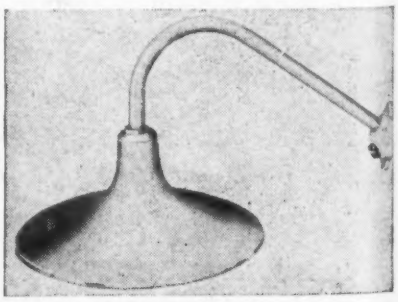
Cast Aluminum Reflector on New Yardlight

A NEW yardlight designed for use in heavy snow and high wind areas, has been placed in production by the Steber



Mfg. Co., Broadview, Ill. It consists of a heavy aluminum 14-in. reflector and a 21-in. neck made of ½-in. pipe as illustrated.

It is said to be designed for all-weather use and to give wide light distribution with a 150-watt lamp. It

TROUBLE PREDICTED

COMPLAINTS FORESTALLED

DEFECTS REVEALED

Bristol's All-Purpose Portable Voltmeter gives you a convenient means of quickly analyzing conditions, making voltage surveys, general testing, investigating complaints — helping you to maintain a high standard of voltage regulation.

Double-record Voltmeters help check the balance on three-wire systems and to study voltage drop in a section of the circuit.

Three-record Voltmeters are used in investigating conditions in three separate circuits or in polyphase networks, and for determining voltages at load centers and ends of feeders.

BRISTOL'S ALL-PURPOSE PORTABLE VOLTMETER

Easy to handle — weighs only 17 pounds. Can be carried anywhere, mounted anywhere — outdoors or on a damp cellar floor. Will take constant handling without affecting accuracy.

Bulletin E1100 describes replaceable measuring element, gravity-controlled pen pressure, fine-bore platinum-tip fountain pens, integral resistors. Address THE BRISTOL COMPANY, 116 Bristol Rd., Waterbury 91, Conn. (The Bristol Co. of Canada, Ltd., Toronto, Ont. Bristol's Instrument Co., Ltd., London, N. W. 10, England). Makers of Metameter, Recording Ammeters and Voltmeters, Thermoverter, and a broad line of automatic controlling and recording instruments.

Gives You the Facts when and where you want them

AUTOMATIC RECORDING AND CONTROLLING INSTRUMENTS

—here's how to SAFEGUARD it!

Apply carbon dioxide with a *Kidde* Total Flooding System

You'll find *Kidde* Total Flooding Systems as fast and sure in safeguarding oil storage and reclamation rooms as they are in protecting electrical equipment.

Automatically or manually operated, a *Kidde* Total Flooding System fills the entire threatened area with carbon dioxide to the point where fire *cannot* exist. In twenty seconds or less, the blaze is completely extinguished!

And a *Kidde* System is *always* ready for action. No pumps or other power sources needed for operation. No recharging needed except after use. No maintenance except a simple periodic weight check.

Remember . . . carbon dioxide is dry, inert, speedy, clean.

Ask a Kidde representative for the full story!

Walter Kidde & Company, Inc., 430 Main Street, Belleville 9, N. J.

The word "Kidde" and the Kidde seal are trade-marks of Walter Kidde & Company, Inc.

Kidde

FIRE PROTECTION HEADQUARTERS

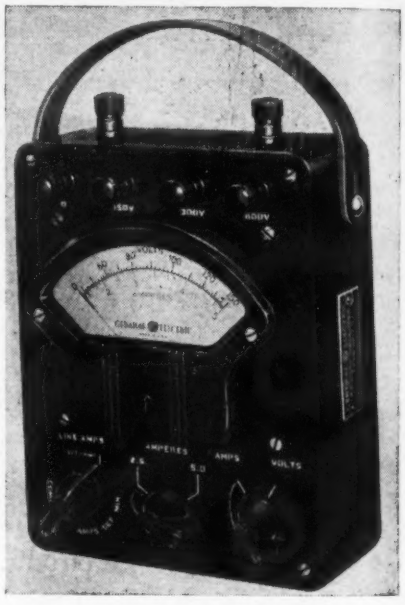
is furnished complete with socket, No. 14 wire, and a cast aluminum wall flange with a 2-hole insulating bushing, and a 2-in. lag screw. This is stated to be ample space in the flange for splicing.

•

New Load Visualizer Is Multi-Purpose Unit

THE NEW AF-1 a.c. load visualizer, a lightweight analyzer for use on single-phase and balanced polyphase systems, has been announced by the meter and instrument division, General Electric Co., Schenectady, N. Y.

Besides serving as a standard 0-2.5/5-amp. ammeter and 0-150/300/600-volt voltmeter, this instrument can be used



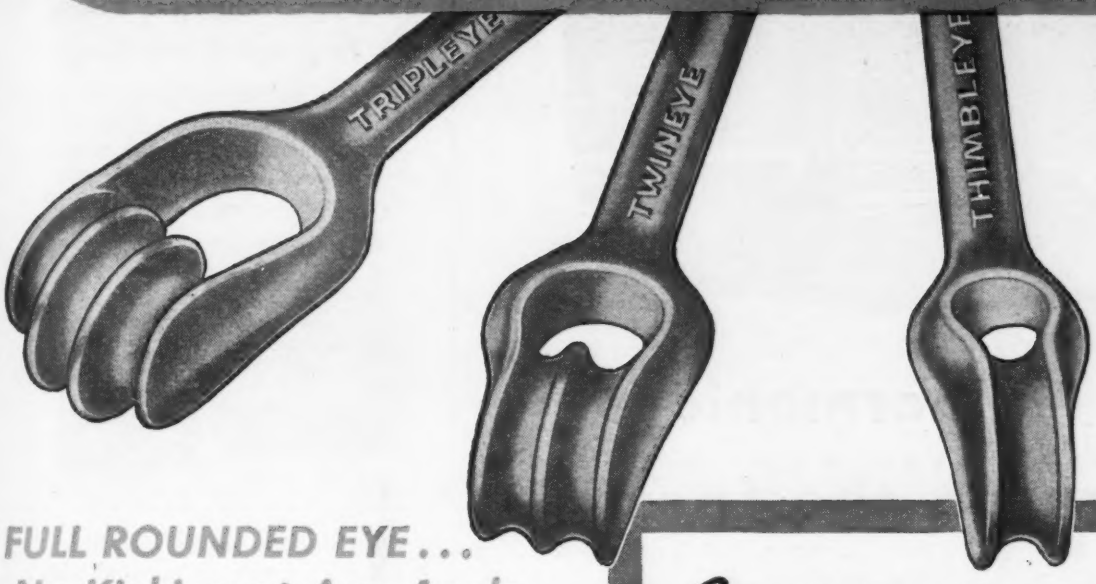
with the calculator furnished to determine watts, vars, volt-amperes, and power factor for load surveys, induction motor tests, reactive-power studies and power-factor checks on power and lighting circuits, the company reports.

The load visualizer has an iron-vane moving element and separate field winding for voltage and current. The current winding is electrically insulated from the imposed voltage by an internal double current transformer. The current and voltage terminals are energized simultaneously from the line or through instrument transformers to extend the range.

Operation of the instrument is controlled by three selector knobs which are placed at the end opposite the connection terminals. The external current circuit is not interrupted by operation of any of the three control knobs, the company states.

It is housed in a greaseproof black Textolite case. Potential terminals, instrument mechanism and control switches are mounted on a Textolite top-

CHANCE Improved THIMBLEYE
Gives GREATER Protection to Guy Strand



FULL ROUNDED EYE...
No Kinking at Any Angle
GROOVED to Fit Guy Strand

Chance Thimbleye Anchor Rods, and Guying Fixtures, the FIRST choice of users for many years, have recently been improved by Chance engineers. The redesigned eye forms a perfectly shaped "Thimble" and the sidewalls and groove of the eye extend around the head of the rod. This keeps the strand from flattening under tension, preserves its cylindrical shape and *prevents it from kinking* at any one point. The sidewalls of the groove are formed to fit snugly around the guy strand, preventing it from flattening under tension.

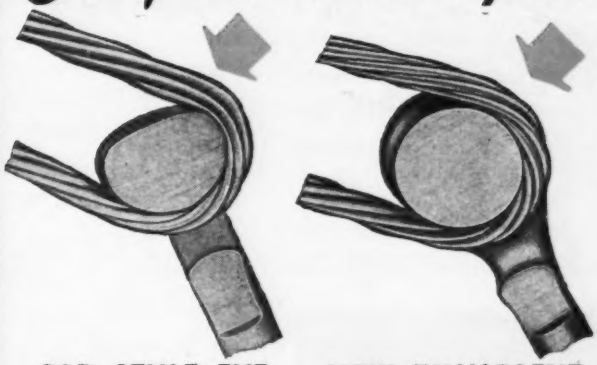
You will instantly see that the newly designed eye gives greater protection to guy strands than the old style eye.

The Improved Thimbleye is available in threaded rods, Never-Creep rods, and the complete line of guy fixtures.

For greater line security, specify Chance Thimbleye Anchor Rods and get this additional protection. Order through your regular source of supply.

Chance Thimbleyes are manufactured and distributed by the A. B. Chance Company and the following manufacturers: Joslyn Mfg. & Supply Co., Chicago, Illinois, Line Material Co., Milwaukee, Wisconsin, Oliver Iron & Steel Corp., Pittsburgh, Pennsylvania, Kortick Mfg. Co., San Francisco, California, Seyler Mfg. Co., Pittsburgh, Pennsylvania, Locke Insulator Corporation, Baltimore, Maryland, N. Slater Company, Ltd., Hamilton, Ontario.

Compare these eyes!



OLD STYLE EYE

Notice the strain placed on guy strand when used at angle with old style eye.

NEW THIMBLEYE

The new Chance Thimbleye *protects* the guy strand from strain at any angle.

Diagram at left shows how the guy strand is supported and protected by the snug-fitting sidewalls of the groove, which extend all the way around the head of the rod.

C473

abc INDUSTRIES

A·B·CHANCE CO·

CENTRALIA, MO. • SAN FRANCISCO, CALIF.

The Philharmonic is down on the farm

Those sounds drifting out into the night aren't what you might expect. You won't hear the groan of a parlor organ, but the deep-throated song of the cello—the full grandeur of a symphonic broadcast.

Rural electrification has not only brought labor-saving tools to the farm, but also many of the pleasures and conveniences of city life.

The electrical farm is here in the United States. Owens-Illinois is proud to have carried an important role by supplying dependable pin-type glass insulators for medium voltage power lines. Traditional Owens-Illinois quality is maintained in every step of manufacturing, testing and inspection.

•

Inspection of Owens-Illinois Power Insulator No. 514 (designed for 15,000 volt lines) is conducted in accordance with Edison Electric Institute specifications TD-51-1942, as is the inspection of all Owens-Illinois Power Insulators.

These insulators are manufactured by a pioneer company in the glass insulator field and are sold by principal jobbers.

OWENS-ILLINOIS POWER INSULATORS

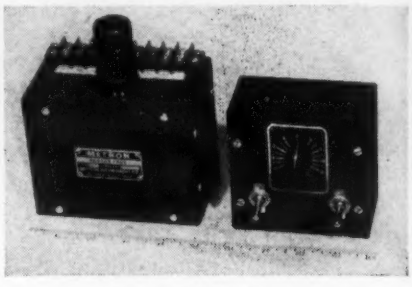
Owens-Illinois Glass Company, Hemingray Division, Muncie, Indiana

plate. The top-plate is secured to the housing by four corner screws which are removable to permit inspection of the wiring and components. The instrument is magnetically damped, fully shielded, and equipped with an external zero set.

•

Welding, Industrial Timer Has Step and Fixed Control

A SMALL and versatile timer designed especially for mounting on welding and industrial equipment by the manufacturer has been developed by the Metron Instrument Co., 432 Lincoln St., Den-



ver 9, Col. The control box, which is 4 x 4 x 2 in., can be mounted with a bracket or incorporated in the machine by flush mounting in any panel surface near the operator with the timer box mounted elsewhere if desirable. The control box can be screwed to the timer box for mounting as an integral unit if desirable.

The timer is of the electronic type. Timing intervals from 1/60th of a second up to several minutes can be provided in one or several continuously variable ranges. Adjustability by steps or fixed timers is also available. The company reports that timing accuracy is substantially unaffected by wide variations in line voltage or temperatures.

•

FM, Television Lead-in Cable Has Low Transmission Loss

FM AND TELEVISION lead-in cables, designed to connect antennas with receivers for minimum transmission loss, have been reported by the specialty division, General Electric Co., Thompson Rd., Syracuse, N. Y. Available in three sizes with impedances of 100 and 300 ohms, they may be used also for amateur transmitters and special purpose wiring in electrical instruments, according to R. S. Fenton, of the radio parts division.

Feature of the new low-loss cables, which help maintain the strength of the incoming signal for high frequency receivers, is the use of extruded polyethylene insulation, he said. The in-

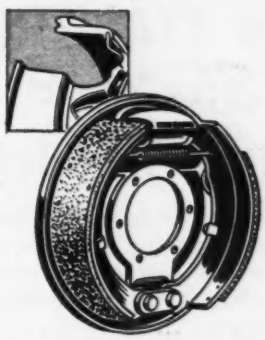
"THINK they last longer? Mister, I KNOW

FORD TRUCKS LAST LONGER!"

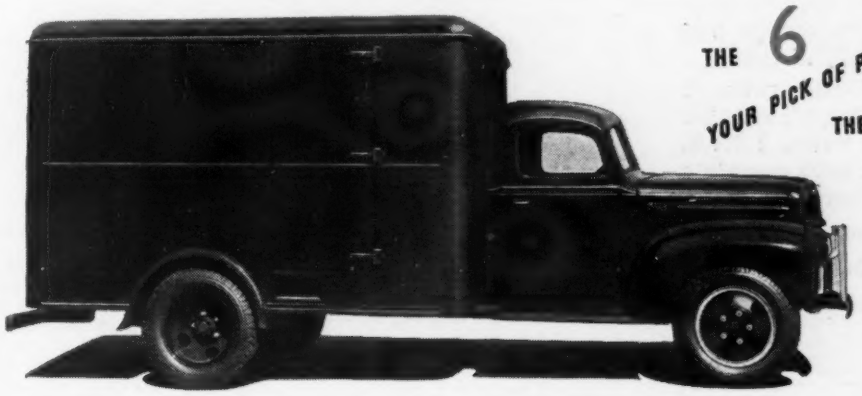
That's what Mr. R. G. Colvert of Ardmore, Oklahoma, wrote recently. "One of our Ford Trucks 11 years old," he added, "has gone over 250,000 miles and it's still on the job, with lots of good miles in it!"

ONE big reason—FORD BRAKES STAND UP!

The wide, heavy, cast drum surfaces of Ford Brakes are non-warping and score-resistant. They are interlocked and fused with steel drum discs during casting, providing great strength and reducing weight. The two shoes are independently anchored, each shoe being actuated by its own hydraulic piston. Adjustment is extremely simple and entirely external. Brakes are exceptionally stable in adjustment. Entry of water and dust is minimized by closely fitted tongue-and-groove design, where edges of drums meet backing plates. Ford brake design promotes long lining life, consistent performance, extra-safe stopping ability and easy pedal pressure.



Ford



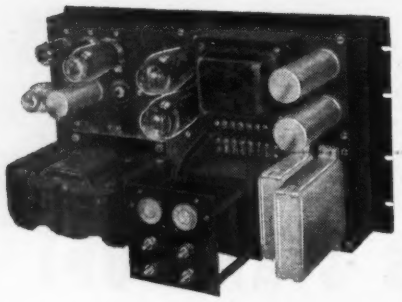
THE 6 YOUR PICK OF POWER THE V8

For maximum load protection and easy maneuverability, the 158" Ford heavy duty chassis with standard Ford cab and a good closed van body is a national favorite. The Van shown is by Maday Body Works, Buffalo, N. Y.

ONLY FORD GIVES YOU *ALL* THESE LONG-LIFE FEATURES: Your pick of Power—the great V-8 or the brilliant Ford Six—extra-strength frames, with siderails *doubled* in heavy duty models—new Flightlight, 4-ring, oil-saving pistons—full-floating and ¾-floating axles, with axle shafts free of weight-load . . . more than fifty such endurance-engineering features in all. It's because of this long-life construction that *of all trucks 14 years old or older on the road today, there are more Ford Trucks than all other makes combined!* More than 100 body-chassis combinations to choose from. Ask your Ford Dealer to show you!

MORE FORD TRUCKS IN USE TODAY THAN ANY OTHER MAKE!

IT'S NEW



The STABILINE *Electronic* Voltage Regulator

Instantaneous in action with a maximum waveform distortion of 3 percent — this new completely-electronic voltage regulator maintains a stable output . . . within ± .1 volt of nominal for line variations from 95 to 135 volts; within ± .15 volt of nominal for any load current change or load power factor change from lagging .5 to leading .9.

Rated — Input: 95-135 volts, 1 phase, 60 cycles. Output: settable between 110-120 volts, 1 KVA. Let us supply you with complete technical and performance data.

WRITE - - - PHONE - - - WIRE OR MAIL THIS COUPON TODAY

THE SUPERIOR ELECTRIC CO. W
BRISTOL, CONNECTICUT

Gentlemen:

Please forward complete engineering and performance data on the new STABILINE electronic voltage regulator.

Company_____

Address_____

City_____ State_____

Name_____ Position_____

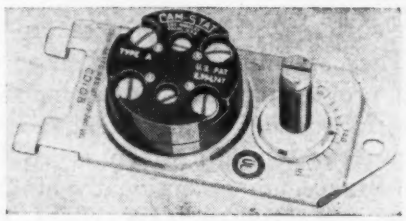
sulating material insures resistance to water, oils, acids, alkalies, aging and general deterioration, it was reported.

The type size of the lead-in cables is prescribed by its specific application. For example, the 300-ohm television-FM and deluxe television cables both have a capacitance of 5.8 mmf. per ft. and 82 percent velocity of propagation, yet the latter is somewhat larger and more heavily insulated because it is recommended for long-span and outdoor installations. Both types' polyethylene dielectric constant is 2.30. Also for special application is an r-f cable having an impedance of 100 ohms with a capacity of 15 mmf. per ft. and 72 percent velocity of propagation.

•

Water Heater Control Has 3,000-Watt Rating

A NEW automatic electric water heater control featuring high current carrying capacity and simplicity of installation is now available for delivery, according



to the manufacturer, Cam-Stat, Inc., 2037 South La Cienega Blvd., Los Angeles, Calif.

Rating of this Type CD108 control is 3,000 watts at 120-240 volts, a.c. Both primary, or lower, and secondary, or upper, thermostats have a temperature range of 60-190 deg. F. Differentials are 10 deg. F. for the primary thermostat and 25 deg. F. for the secondary thermostat in accordance with NEMA Standards. Lower differentials are available. Switching arrangement is either SPST break on temperature rise or independent circuit double throw.

•

Diathermy Equipment Overcomes Radio Troubles

NEW MICROWAVE diathermy equipment radiating energy at 2,450,000 kilocycles per seconds has been developed for the medical profession by Raytheon Mfg. Co., Waltham, Mass. The unit, called Microtherm, is reported to overcome objectionable radio interference of older designs, and to eliminate the need for strapping electrodes to the patients. Due to its wavelength, the energy is directed at the patient light a beam of light.

ALWAYS HOLD TIGHT
•
EASY AND FAST TO ASSEMBLE
•
LOW IN COST
•
WITHSTAND HIGH TEMPERATURE
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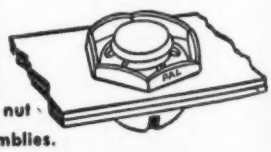
DO NOT DAMAGE NUT OR NUT SEAT

Used as locknut on heavier assemblies.



Used alone as self-locking nut on lighter assemblies.

● Send details of your application for recommendation and free samples. Ask for literature describing Palnut double-locking principle, advantages, types, etc.

THE PALNUT COMPANY
51 Cordier St.,
Irvington 11,
N. J.

DOUBLE-LOCKING PALNUTS

CATALOGS and BULLETINS

A monthly digest of recent manufacturers' literature compiled by Electrical World for your convenience in securing without obligation the most recent information on electrical and allied products.

CHECK ON COUPON BULLETINS DESIRED AND MAIL TO US. WE WILL FORWARD REQUESTS TO MANUFACTURERS

1 POWER PLANT EQUIPMENT: Bulletin Q-12 briefly describes and illustrates equipment for power plants and industrial processes. Includes steam turbines, motors, generators and feedwater heaters to turbo-chargers, steam jet ejectors and centrifugal blowers. Illustrations are shown. Elliott Co.

2 MOTORS: Bulletin C-30 features heavy duty d.c. crane motors, built especially to withstand severe duty service where rapid acceleration and frequent reversals are required. Motors range from 7½ to 65 hps. Open view illustrations are furnished with engineering data. Harnischfeger Corp.

3 HOT-CATHODE GERMICIDAL UNITS: Bulletin 79 discusses methods of protecting food products by the use of ultraviolet germicidal units designed to house hot-cathode germicidal lamps. Contains pertinent know-how" information on the use of these units. Technical information is also included. Tru-Air Ultraviolet Products Co.

4 CONNECTORS: Bulletin P-1 presents new hydent connectors for coaxial and shielded cable. Utilizing the indent principle, these connectors permit the making of connections in coaxial cable or the grounding of shielded cable without the use of solder or application of heat. Detailed explanation by means of illustrations show how installations of these connectors are made. Burndy Engineering Co. Inc.

5 ALARM SYSTEMS: Bulletin U46 outlines briefly how alarm systems, called "Unilarm" by this manufacturer, operate. They are designed chiefly for maintaining continuous process control in oil refineries, synthetic rubber manufacturing processes. Text includes technical data, illustrations, wiring diagrams and tables containing pertinent information on component elements of unit. Russell & Stoll Co. Inc.

6 SWITCHES: Bulletin 52 covers technical details of switch suited for application where corrosive or dirty atmospheres are encountered. Switch furnished in capacities from 2,000 amp. to 10,000 amp. and over, single and multiple. Drawings furnished construction details. Albert & J. M. Anderson Mfg. Co.

7 FIRE EXTINGUISHING EQUIPMENT: Bulletin, Vol. 3 No. 2, contains explanatory text on how to use the proper fire extinguishing equipment for a specific job. Methods of applying extinguishing fluids are also discussed. Illustrations show equipment in use under actual fire conditions. Walter Kidde & Co., Inc.

8 WIRE & CABLE: Publication C-60, entitled "The Story of 1946 Code Changes," endeavors to include all of the changes directly affecting types of materials and permissible methods of installation. This booklet is an analysis of these changes in so far as they affect wire and cable, illustrating what those changes mean in terms of dollars and cents. Anaconda Wire & Cable Co.

9 BATTERY CHARGERS: Bulletin B-206 covers a special type single-circuit, three-phase battery charger for motorized hand-lift trucks. Open-view drawing of unit is furnished showing mechanical features in detail. Each piece of equipment noted with explanatory data. Complete specifications are also given. The Electric Products Co.

10 PRESSURE CONNECTORS: Bulletin 64 contains complete information on this manufacturer's pressure connectors. Includes illustrations and photographs depicting various applications of several of the items in the line as well as brief resumés of pressure connectors in allied lines. Provides also wire and cable sizes and miscellaneous ordering information. The Thomas & Betts Co.

11 RESISTORS & RHEOSTATS: Catalog D-2 gives complete data on this manufacturer's wire-wound vitreous enameled resistors used by radio, television, radar, and other electronic industries. Illustrations and tables contain pertinent technical data. Ward Leonard Electric Co.

12 MOTOR-GENERATOR CHARGER: Bulletin 101-10M-6-46 describes and illustrates fully automatic motor-generator used for charging motorized lift-truck batteries. Open view drawing presents mechanical construction of equipment in detail. Pertinent technical details are also included. The Hertner Electric Co.

13 SYNCHRONOUS MOTORS & MOTOR CONTROLS: Publication 1068 discusses operating characteristics, power factor, torques, flywheel effect, speeds, excitation starting kva., braking, motor protection and five principal types of control. Illustrations, diagrams, tables and costs are included. Electric Machinery Mfg. Co.

Circle numbers, sign and mail — *Coupon good until June 1, 1947 only*

ELECTRICAL WORLD — April 12, 1947
330 West 42nd Street, New York 18, N. Y.

Please send me, without obligation, manufacturers' literature herein described and identified by numbers circled below:

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NEWS ABOUT PEOPLE

Ohio Edison Puts M. Smith in Charge of Construction

Malcolm W. Smith, superintendent f electrical construction for the Ohio Edison Co., has been appointed to the

M. W. SMITH

newly created position of superintendent of production and transmission construction.

Alfred L. Richmond, superintendent of electrical operations, will take on the additional duties of maintenance of all electrical equipment installed in operating stations and substations.

A graduate of Penn State College in 1922, Smith worked for a year with the Carnegie Steel Corp. before joining West Penn Power Co. as a service engineer. Then in the employ of Stevens & Wood, Inc., he worked on the construction of the Toronto steam station for the Ohio River Power Co., a predecessor of Ohio Edison.

When the plant was complete, he served as its chief electrician for ten years. In 1937, he became superintendent of electrical construction for Ohio Edison.

Richmond has been with Ohio Edison and a predecessor company since 1913. He has been superintendent of production, and superintendent of electrical operations.

•

▶ DR. JOHN A. HIPPLE, an outstanding authority on the design, construction and use of the mass spectrometer, has been appointed chief of the atomic physics section at the National Bureau of Standards. In this capacity, Dr. Hipple will direct research on the ionization and separation of molecules by electron impact and the processes involved in these phenomena. He goes to the Bureau staff from the research laboratories of the Westinghouse Electric Corp., where he has been section manager in the electro-physics division. Dr. Hipple has published extensive research papers in scientific journals and holds numerous patents in his field.

•

Syracuse E.E. Department Adds 5 Faculty Members

Dr. Ralph A. Galbraith has been appointed professor of electrical engineering and chairman of the department at Syracuse University, succeeding Prof. Charles W. Henderson who relinquished the chairmanship because of ill health.

Dr. Galbraith, a graduate of the University of Missouri and of Yale University, has taught at the University of Texas and at the Georgia School of Technology. During the war, he served on the staff of the Radar School at Massachusetts Institute of Technology. He has had experience in the research department of Detroit Edison Co. and was for a time research electrical engineer for the Century Electric Co., St. Louis.

Other appointments to the department at Syracuse include that of Dr. Carl S. Roys, formerly of the Illinois Institute of Technology, to professor; Dr. Samuel Seely, formerly of the Naval Post-Graduate School at Annapolis, to professor; Dr. Wilbur R. LePage, senior research engineer, Stromberg-Carlson Co., to associate professor; and Samuel E. Clements, recently of the Army Signal Corps, to associate professor.

•

▶ E. C. WICKERSHAM, application engineer, has been promoted to assistant sales manager of the Leland Electric Co. to succeed J. J. DAGGON, formerly vice-president in charge of sales, who has resigned to establish his own business.

Dickey Made Sales Director of Federal Telephone

Appointment of Clyde E. Dickey as general sales director of Federal Telephone & Radio Corp., Clifton, N. J., has been announced.

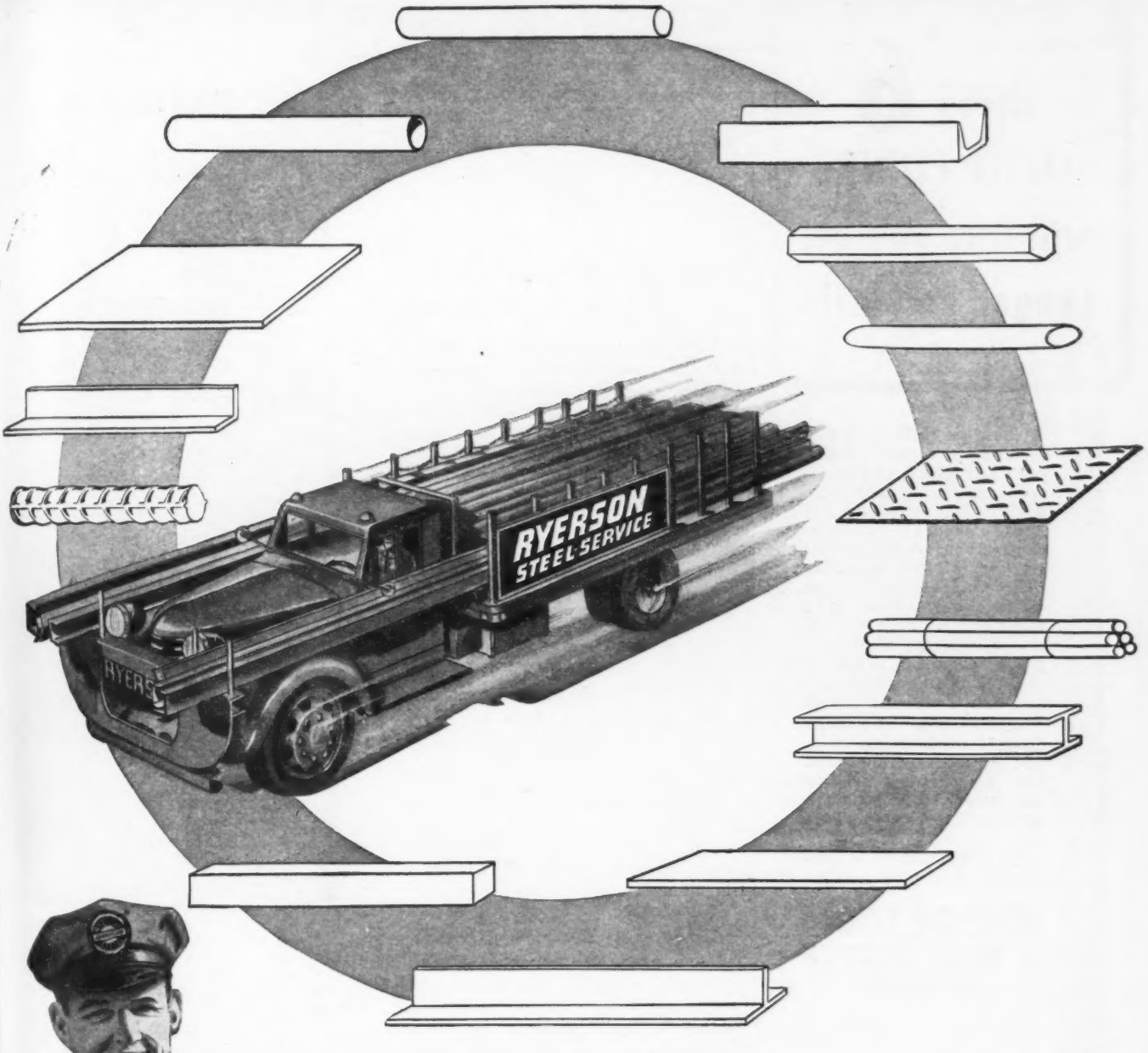
Mr. Dickey, who has been associated with I.T. & T. for more than 19 years,

C. E. DICKEY

will be in charge of the following Federal sales activities: commercial radio, rectifiers, Megatherm, wire transmission, rectifier stacks, wire and cable, tubes, transformers, crystals and air lines. Telephone sales will report to him functionally.

•

▶ DANIEL K. COYLE has been appointed general sales manager of the Sacramento Municipal Utility District to direct sales promotion, advertising and new business activities of the district which took over local facilities of Pacific Gas & Electric Co. on January 1. Mr. Coyle served for many years in both operating and sales departments of P.G. & E., but more recently has held executive engineering and sales positions with Kelvinator, General Motors and the Joshua Hendy Iron Works. A. L. PERDUE has been made commercial and industrial sales manager. Mr. Perdue was formerly connected with the Oliver Iron & Steel Corp. His earlier connections were with Pacific Gas & Electric and Westinghouse Electric



when it comes to steel—

Our Business is YOUR Business

For more than a hundred years, each step forward in American industrial methods has been faithfully reflected in the specialization and development of Ryerson steel. With the coming of each new manufacturing technique, the scope of Ryerson stocks has been increased to include the potential requirements of the operation. And Ryerson service methods have been steadily developed to meet the ever-growing demand for speed and dependability.

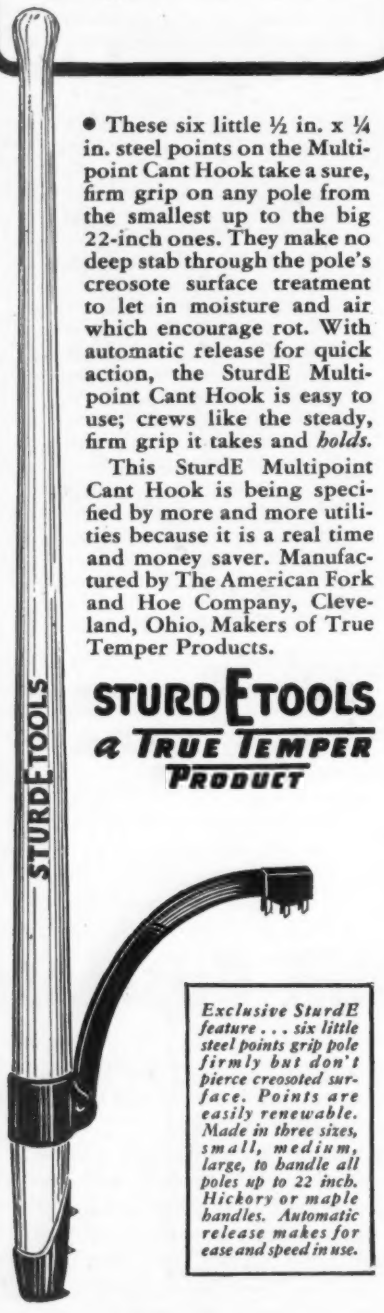
During these days of critical shortages, Ryerson policy of prompt personal attention to each order remains the same. Whether your requirements are measured in pounds or tons, they receive the immediate consideration of experienced steel men. And if the steel you need is not readily available from stock, every effort will be made to find an alternate to serve your purpose.

So contact Ryerson when the continued progress of your operation depends on steel. Whether your business consists of a one-room machine shop or an industrial empire, you are always assured of our fullest cooperation and the benefit of unequalled service facilities.

Joseph T. Ryerson & Son, Inc., Steel-Service Plants: New York, Boston, Philadelphia, Detroit, Cincinnati, Cleveland, Pittsburgh, Buffalo, Chicago, Milwaukee, St. Louis, Los Angeles.

RYERSON STEEL

THESE 6 LITTLE POINTS will help you get Longer Pole Life



• These six little ½ in. x ¼ in. steel points on the Multipoint Cant Hook take a sure, firm grip on any pole from the smallest up to the big 22-inch ones. They make no deep stab through the pole's creosote surface treatment to let in moisture and air which encourage rot. With automatic release for quick action, the SturdE Multipoint Cant Hook is easy to use; crews like the steady, firm grip it takes and *holds.*

This SturdE Multipoint Cant Hook is being specified by more and more utilities because it is a real time and money saver. Manufactured by The American Fork and Hoe Company, Cleveland, Ohio, Makers of True Temper Products.

STURDETOOLS
a **TRUE TEMPER PRODUCT**

Exclusive SturdE feature . . . six little steel points grip pole firmly but don't pierce creosoted surface. Points are easily renewable. Made in three sizes, small, medium, large, to handle all poles up to 22 inch. Hickory or maple handles. Automatic release makes for ease and speed in use.

Distributed by
JOSLYN MFG. & SUPPLY COMPANY
20 North Wacker Drive • Chicago, Illinois
Branches and Warehouses with Complete Stocks in Principal Cities of the United States

Supply Co. J. F. BARRETT, who has been connected with P.G. & E. for 25 years, has been made assistant commercial manager. WALTER H. LINDSAY, another Pacific Gas employee, Sacramento division, has been made rural power supervisor for the district.

•

Tuttle & Kift, Inc., Names 3 New Vice-Presidents

The recent expansion of Tuttle & Kift, Inc., has led to the appointment of three new vice-presidents.

H. F. Bond will be vice-president in charge of sales. He was formerly assistant to the president of Ferro Enamel Corp., of which T. & F. is a subsidiary.

George W. Wallace. in addition to his duties as assistant secretary and comptroller of Ferro Enamel, will also become a vice-president of T. & F.

R. P. Blodgett, formerly chief engineer, assistant to the president, and works manager, has been made vice-president in charge of manufacturing.

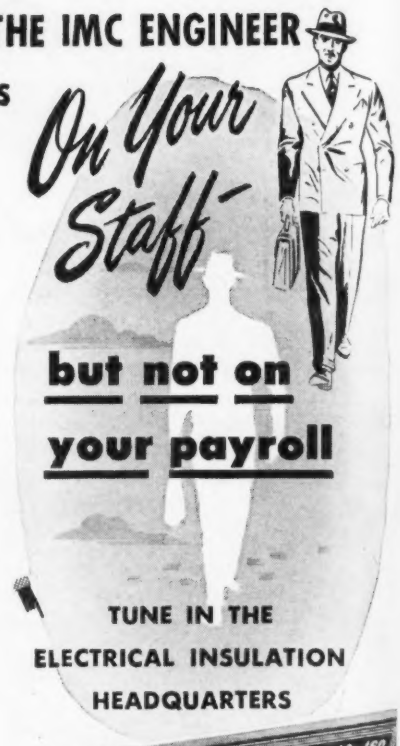
•

► DUNCAN SHAW, business man and expert on municipal utility securities, has been appointed a member of the Los Angeles Board of Water and Power Commissioners, succeeding George K. Simmonds, resigned.

► A. SCUDDER MOORE has been appointed general superintendent of the Brockton (Mass.) Edison Co., succeeding the late Karl C. Mason. A graduate of the University of Maine he entered the utility field in the sales department of the Cape Breton Electric Co. He joined the Brockton company in 1913 and in recent years has been in charge of the industrial power sales department of the company.

► DR. HARVEY L. CURTIS, physicist at the National Bureau of Standards since 1907, has retired. Dr. Curtis, chief of the interior ballistics section and for 32 years chief of the inductance capacitance section, deferred his retirement in 1945 to continue direction of interior ballistics research, the study of internal gun reactions. Distinguished for his research in the field of electricity, Dr. Curtis's major scientific achievement has been in the field of absolute electrical measurements. He has written the standard textbook on the subject. Other important interests have been the study of electrical insulating materials, mica condensers, design of alternating current resistances, photographing projectiles in flight, stresses in turrets of

THE IMC ENGINEER is *On Your Staff*— but not on your payroll



TUNE IN THE ELECTRICAL INSULATION HEADQUARTERS

Because your IMC Engineer represents most of the recognized leading manufacturers of electrical insulation, his experience in this field is unusually complete. He and the IMC organization are qualified to . . .

1. Assist you in the selection of the best insulating material for your job.
2. Familiarize you with its proper application.
3. Suggest ways to eliminate waste.
4. Help you speed up and increase your production.

INSULATION
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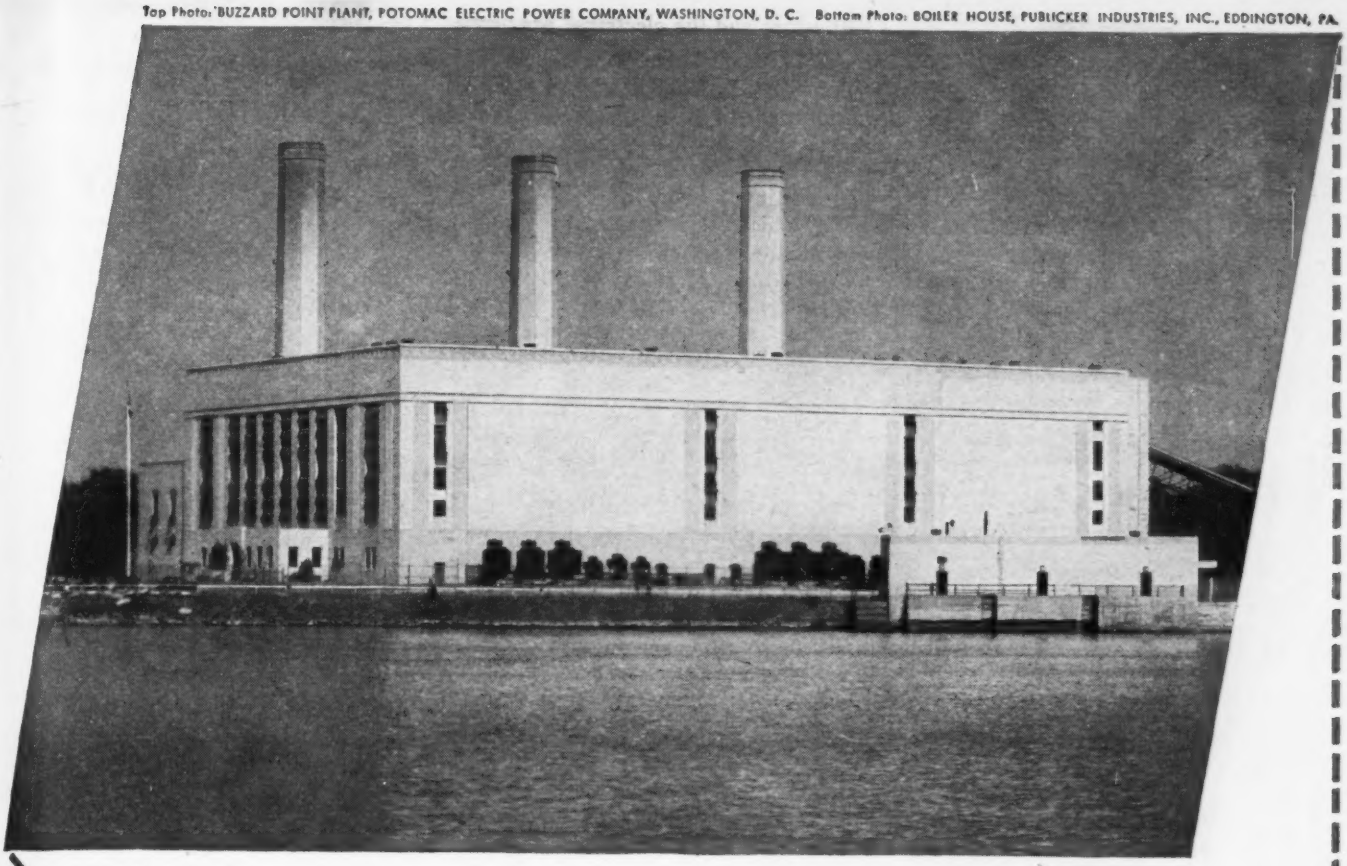
ELECTRICAL IMC INSULATION

* CHICAGO 6, 565 West Washington Blvd.
* CLEVELAND 14, 1231 Superior Ave., N. E.
MILWAUKEE 2, 312 East Wisconsin Ave.
DAYTON 2, 1315 Mutual Home Building

REPRESENTATIVES in: DETROIT 2, 11341 Woodward Ave., MINNEAPOLIS 3, 1208 Harmon Pl., and PEORIA 5, 101 Heinz Court.

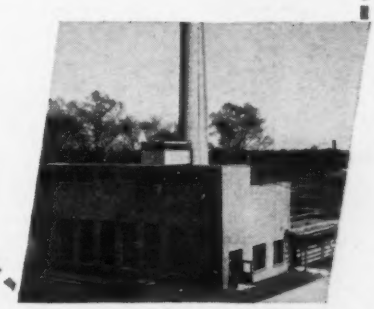
Top Photo: BUZZARD POINT PLANT, POTOMAC ELECTRIC POWER COMPANY, WASHINGTON, D. C. Bottom Photo: BOILER HOUSE, PUBLICKER INDUSTRIES, INC., EDDINGTON, PA.



SIZE IS ONLY RELATIVE

Power plants designed and built by Stone & Webster Engineering Corporation vary in size from small boiler units for industries to large central steam generating stations for utilities.

We welcome the opportunity to apply our wide experience and demonstrated ability to the design and construction of plants of any size.



STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY OF STONE & WEBSTER, INC.

SUPERIOR

SINCE 1923

The name SUPERIOR has stood for top quality meter testing and installation equipment – built specially for the

UTILITY INDUSTRY

SUPERIOR SWITCHBOARD & DEVICES CO.

CANTON 1, OHIO

A subsidiary of The Union Metal Manufacturing Co.

battleships and the electrical properties of rubber. Dr. Curtis is a fellow of the American Institute of Electrical Engineers and the American Association for the Advancement of Science, and he has also been an active member of the American Society for Testing Materials, having served as chairman of the committee on electrical insulating materials from 1930 to 1934. Since 1934 he has been chairman of a similar committee for the American Standards Association.

•

New Assignments Made by Sylvania Electric

Several new appointments have been announced recently by Sylvania Electric Products, Inc.

HENRY W. PARKER has been made technical adviser, a new position created to stimulate review of industrial and scientific developments of interest to the central engineering laboratories and to propose new projects in research and development. Prior connections included General Electric Co. and Rogers Radio Tubes Ltd. of Toronto.

F. R. ARCHER has been named merchandising supervisor of fluorescent products. Before joining Sylvania in 1940, Mr. Archer was affiliated with the Barkon Frink Tube Lighting Corp. and prior to that was associated with the Westchester Lighting Co. as director of lighting promotion and sales for ten years and with Henry L. Doherty in a design capacity.

CHARLES H. GODDARD, assistant general sales manager of the lighting division, has been appointed general manager of the fluorescent fixture division, with headquarters at the Ipswich, Mass., plant. Mr. Goddard first became associated with Sylvania in 1944. Active in lighting circles, Mr. Goddard is treasurer of the Illuminating Engineering Society and represents Sylvania in the Lighting Fixture Section of the National Electrical Manufacturers Association.

JEROME R. STEEN has been made director of quality control for the lamp, fixture, wire products, tungsten and chemicals, radio tube and electronic divisions. Mr. Steen joined the staff of Sylvania Electric in 1931.

LOUIS S. KIMBALL, general manager, fluorescent fixture division, has been elected vice-president in charge of operations of Colonial Radio Corp., which is a wholly owned Sylvania Electric subsidiary, with headquarters at the main office of Colonial, Buffalo, N. Y. Mr. Kimball has been with Sylvania since 1942.

MILTON E. LAUER has been appointed

Protection for POLES AND CROSS-ARMS — old or new

Chapman "Penta" Preservative is rapidly winning acceptance as the preferred material for pressure-treatment of wood which is to be exposed to moisture and insects. Tests prove its superior qualities. Linemen and other workers like it because the poles are clean—not sticky.

"Penta" Preservative can be sprayed or painted on poles, cross-arms or other timber already in place, or treatment can be by soaking if pressure equipment isn't available. In the absence of pressure treatment, non-pressure methods with "Penta" Preservative are very useful either for new stock, poles and timber in service, or reclaimed poles and cross-arms.

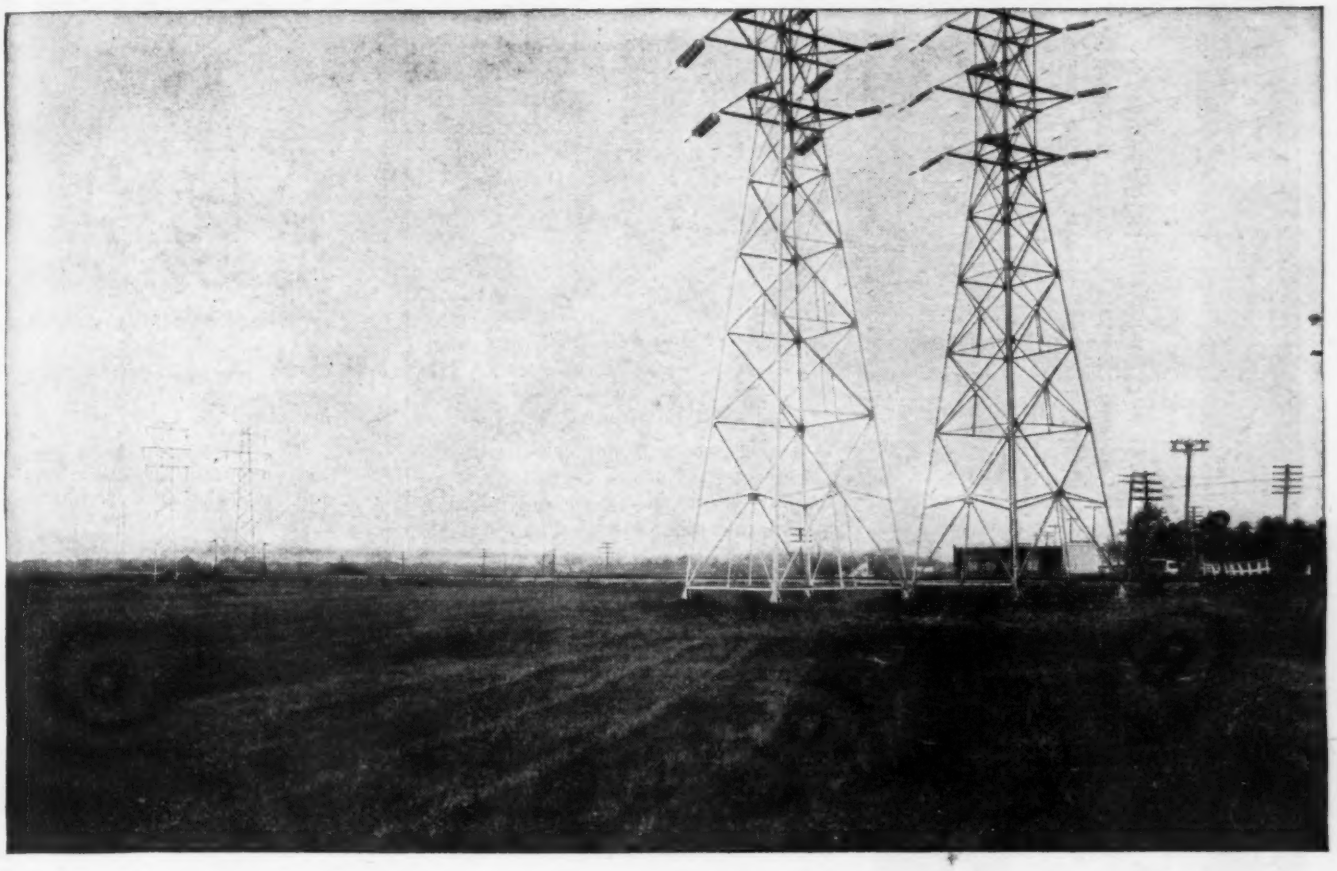
We'll be glad to supply details and facts about Chapman "Penta" Preservative for protecting old or new poles and other timber. Write us today.

CHAPMAN

CHAPMAN CHEMICAL COMPANY
Suite 542
333 North Michigan Ave., Chicago 1, Ill.

"Penta" Preservative contains *Pentachlorphenol*, a product of *The Dow Chemical Company*.

Control Weeds Effectively—Economically!



2-4 Dow Weed Killer

Low Cost. Highly recommended for killing broad-leafed weeds in lawns to beautify parks, streets, and company buildings. Not harmful to most grasses. Available both as a liquid and a powder.

Esteron 44—a powerful 2, 4-D Weed Killer

Especially useful against many types of woody plants, such as wild rose, poison ivy, mesquite and sprouts of many other woody species. Ideal for use on cut-over land along rights of way. Not harmful to most grasses.

Dow Contact Weed Killer

"Chemical Mower" for weeds along canals, ditch banks, fences and roads. Kills most annuals completely. Destroys all weeds and grass above ground, leaves roots to prevent soil erosion.

Economical and effective control of many stubborn, troublesome weeds along highways and rights of way is now possible through proper application of the right Dow Weed Killer!

Maintenance men everywhere are pleased when field crews report that *spraying* weeds to death is so *simple*—saves so much *time*—gets such excellent *results!* And when the cost figures come in—when the dollars and cents savings prove the economy of chemical weed control—that settles it! No more mowing, digging or hoeing—it's Dow Weed Killer for *better* weed control!

Results of many tests and successful applications are available for your inspection. The complete story of Dow Weed Killers is yours for the asking—without obligation. Consult your usual source of supply—or write to Dow direct. Get the facts!

Cut maintenance costs with—

DOW WEED KILLERS

AGRICULTURAL CHEMICAL DIVISION
THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN
New York • Boston • Philadelphia • Washington • Cleveland • Detroit • Chicago • St. Louis
Houston • San Francisco • Los Angeles • Seattle
Dow Chemical of Canada, Ltd., Toronto, Ontario

DOW
CHEMICALS INDISPENSABLE TO INDUSTRY AND AGRICULTURE

HOW TO MAKE POLES LAST LONGER

Just off the press. A factual booklet describing 12 years field experience with OSMOPLASTIC in ground line treatment of standing poles as well as other timbers. Explains the Osmoplastic method of treatment in detail. Write for your copy.

OSMOSE WOOD PRESERVING CO. OF AMERICA, INC. 1437 BAILEY AVE., BUFFALO 12, NEW YORK

to the newly created position of product manager of the radio tube division. Mr. Lauer joined the company in 1933.

▶ DR. SAMUEL G. LUTZ, formerly head of the measurements and direction-finding section of the Naval Research Laboratory, Washington, D. C., has been appointed chairman of the electrical engineering department of the college of engineering of New York University. Dr. Lutz is a member of the American Institute of Electrical Engineers.

▶ ALBION DAVIS has retired as chief hydraulic engineer of the Union Electric Co. of Missouri in St. Louis. Mr. Davis has worked in the field of river hydraulics and power for the past 33 years, having been connected with operation of the Keokuk (Iowa) plant on the Mississippi River since 1914, and of both that plant and the Bagnell plant in Missouri since 1931.

▶ JOHN A. TOBYN has retired as plant operating superintendent of the Washington Water Power Co., Spokane, Wash., after 40 years with the company. After holding various operating positions, he was made plant operating superintendent in 1939.

▶ WALLACE B. STRATHDEE has been appointed machinery electrification manager of the New England district of Westinghouse Electric Corp., with headquarters at 10 High St., Boston. He is an electrical engineering graduate of Tufts College; joined Westinghouse in 1927 as a graduate student, and later was located at East Springfield, Mass., and East Pittsburgh, going to Boston in 1929. Recently he has been welding engineer at Boston.

▶ FRANK M. CLARK, insulation expert at the Pittsfield Works of the General Electric Co.'s apparatus department and assistant engineer of the Works Laboratory there, has been named technical consultant on insulation of the entire apparatus department. In his new capacity, Mr. Clark will coordinate the insulation research activities of the company's research department and will assist the apparatus design division in applying those findings effectively. He will also retain his former position at Pittsfield. Mr. Clark has been engaged in insulation research and development work since he joined the company in 1923. For his work in these lines he has twice received the Charles A. Coffin Foundation Award for outstanding achievement. He holds 97 patents, prac-

HI-BOY SIGN

for Street and Highway Use

Will not blow over, leaving your men and the public unprotected.

Sign frame pivoted on each side allowing movement with varying wind pressures and full vision at all times.

Attractively and rigidly constructed folds compactly for storing.

IPCO COMPLETE INFORMATION ON NEW BULLETIN EW-47

Safety Equipment for all Industries

INDUSTRIAL PRODUCTS COMPANY

2808 N. FOURTH STREET • PHILADELPHIA 33, PA.

EVERSTICK ANCHORS...

FOR SPEED IN INSTALLATION

The exclusive Everstick nut housing locks the Anchor firmly on the rod. This speeds up installation. Plates are so designed, that they expand easily into undisturbed earth, and extra holding power is achieved. Made of tough rust-resistant malleable iron. Write for bulletin.

EVERSTICK ANCHOR CO.
FAIRFIELD, IOWA

...J-M TRANCELL MATERIALS
give you safer cell structures

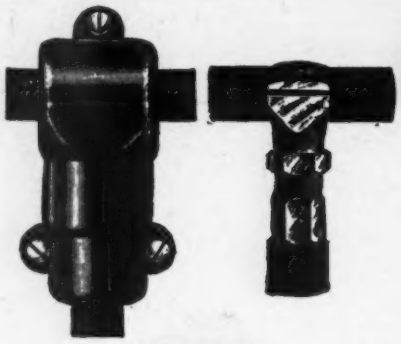
CELL STRUCTURES built with J-M Trancell provide greater safety for station operators... give adjacent equipment greater protection against heat transmission. The reason—J-M Trancell is completely fireproof, rotproof and rustproof . . . is erected entirely *without* water to form a *dry* housing that guards against shorts.

You'll find, too, that Trancell is economical to install because it comes in large sheets that are easily workable . . . can be cut, drilled, and bolted right on the job. Light in weight, Trancell permits the housing of equipment on balconies and upper floors without danger of overloading.

Basically asbestos, J-M Trancell Materials are available in a wide variety of types and combinations to meet every requirement of high-voltage service. You can order Trancell pre-cut to your special dimensions . . . or have it cut by your own maintenance department thereby saving shut-down time, detail drawings, and materials. For complete information, write Johns-Manville, Box 290, New York 16, New York.

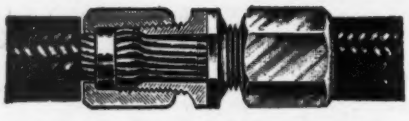
Johns-Manville

TRANCELL
an asbestos product
for housing electrical equipment

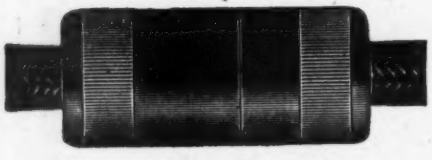


Type DHT

Two-Way Type "A" Construction



Two-Way Type "B" Construction



Two-Way Cover Type TWC

DOSSERT CONNECTORS

TYPE DHT

A hook type cable tap connector. The contact surface of the hook section and the compression gland are accurately machined to fit the conductor run, while the tap off section is available in the type "A" or type "B" construction illustrated below. This connector is available with an insulating cover for making compact insulated connections as illustrated.

TYPE TW

A two way connector for coupling cables on end. Available in the type "A" or type "B" construction as illustrated. The type "B" construction develops many times the tensile strength of the conventional fitting. For instance with a 500MCM cable the tensile strength is 5,350 lbs. Both connectors are available with insulating covers type TWC to make an insulated joint as illustrated.

Send for literature on the type "B" construction which outlines comparative strengths and cable anchor applications.

"INSIST ON GENUINE DOSSERTS"

DOSSERT MFG. CORP.
249-254 HURON ST.
BROOKLYN 22, N. Y.

New! HYPOT Tester for insulation failure • SMALL PORTABLE • SAFE

KILOVOLTS
AC
Complete with power cord and test leads
Indicates insulation breakdowns in SMALL MOTORS CONDENSERS TRANSFORMERS HOUSEHOLD APPLIANCES, etc.

Model 405 5000 V., a-c

Instantly detects any insulation weakness. VISUAL INDICATION of arcing flash-over. Voltage continuously variable, 0 to maximum, by knob on panel. No tap changing. OUTPUT VOLTAGE read on large scale meter direct from H. V. terminals. Handy! Size 6" x 6" x 8". Wt. 16 lbs. Durably cased. Send for bulletin.

ASSOCIATED RESEARCH, Inc.

221-C S. Green Street, Chicago 7, Illinois
Also mfrs. Keeler Polygraph (Lie Detector)

tically all of them in the field of insulation, and is the author of more than 40 articles in the American and European technical press.

▶ G. K. McKee retired from active participation in the management of the Avey Drilling Machine Co., Covington, Ky., on February 1, when he assumed ownership of the Electric Railway Equipment Co., Cincinnati. Mr. McKee, who had been associated with the Avey organization for more than 20 years, is credited with more than a score of patents covering production machinery. Other new officers of the Electric Railway Equipment Co. include A. L. Johnston, vice-president and secretary, and J. E. Eshelby, assistant secretary-assistant treasurer. Mr. McKee, in addition to heading the company as president, is also the treasurer.

▶ John S. Tucker has been named manager of the Connecticut Light & Power Co. at Niantic, Conn.

OBITUARY

▶ James E. Burns, distribution superintendent at the West Lynn, Mass., Works of General Electric Co., and an employee for 47 years, died at a hospital in Lynn on March 29.

▶ Oscar Weiner, 49, president of the Weiner Electric Construction Co., Malden, Mass., died recently at his home in that city.

▶ Edwin O. Edgerton, 71, formerly member of the California Railroad Commission, died recently in Oakland, Calif.

▶ Chester L. Belden, 62, manager of the Montana Power Co. in Livingston, Mont., died March 17.

▶ James L. Fahey, 41, manager of the Butte, Mont., branch of the General Electric Supply Corp., died March 9, in that city. From 1937 to 1946, he was manager at Salt Lake City.

▶ Gordon G. Spencer, general manager of the Eastern Light & Power Co., Sydney, N. S., since its inception in 1931, died March 14. From 1903 to 1931, he was associated with a predecessor utility, Cape Breton Electric Co., and was for many years its assistant treasurer.

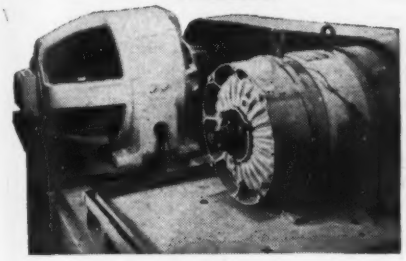
▶ Ernest H. Saunders, 69, formerly superintendent of the Narragansett Electric Co. at Westerly, R. I., died at his home in that city on March 23.

Silicone News

DC SILICONES

Lubricated once with DC 44 Grease...

Bearings Run 3820 Hours at 250° F.



DC 44 Silicone Grease is tested in bearings of DC Silicone insulated motors overloaded to bring bearing temperatures up to 125° C.

DC Silicone Greases, like other Dow Corning Silicone Products, permit operation at temperatures far above and below the limits of comparable organic materials. The Silicone Greases were, in fact, developed to solve a high temperature problem of our own making.

We had developed and were testing DC Silicone Insulation for electric motors. We operated test motors at 200° to 310° C. and found that Silicone Insulation could take such temperatures for thousands of hours. We knew, however, that there would be almost no immediate market for this new class of electrical insulation unless a grease having comparable heat stability was developed.

Then one of our research groups developed DC 44 and DC 33. That was over two years ago. DC Silicone Greases have since been extensively tested and widely used.

DC 44 has proved to be serviceable from −40° to 350° F. and at speeds up to 20,000 r.p.m. It is also characterized by very low volatility, freedom from gumming, bleeding of less than 2% after 16 hours at 110° C. (230° F.), and weight loss of only 3.3% after 40 hours at 175° C. (347° F.).

These properties are most desirable in a grease for permanently sealed bearings. DC 44 is now used for that purpose.

DC 33 has proved to be a very useful grease over the temperature span covered in aircraft operations. It is serviceable at temperatures as low as −70° F. and still has better high temperature performance than special high temperature petroleum greases. Both of these DC Silicone Greases are described in data sheet No. L 7-4.

DOW CORNING CORPORATION
MIDLAND, MICHIGAN

New York • Chicago • Cleveland • Los Angeles
In Canada: Fiberglas Canada, Ltd., Toronto
In England: Albright and Wilson, Ltd., London

Dow Corning
FIRST IN SILICONES

the right answer

—TO YOUR PEAK LOAD PROBLEMS

WATER HEATING CONTROL

Peak-trol is a new method of control for automatically turning off water heaters or other types of off peak loads in accordance with the load on your system. *Peak-trol is not a carrier current system, but instead uses a new type of signal and does not have the limitations associated with carrier current control systems.*

Peak-trol is not limited by distance . . . is not affected by the addition of power factor correction equipment to your system . . . can be expanded indefinitely to cover additional load units . . . does not back up into other distribution systems fed by a common transmission system . . . does not require expensive coupling equipment or line traps . . . requires only a low power signal for reliable operation over extensive systems.

Maintenance costs are low on Peak-trol receivers with only one moving part as a potential source of trouble.

With Peak-trol you have a new modern approach to the control of off peak loads. Investigate the possibilities that Peak-trol offers and learn the economies that will result from its application by writing to your nearest Control Corporation Limited representative.

CONTROL CORPORATION
718 CENTRAL AVE., MINNEAPOLIS, MINN.

MANUFACTURERS & MARKETS

Stress Need for Cooperation Between Utility and Water Supply Industries

"The rural market for pressure water systems and for electrical power is of such magnitude that only by unlimited cooperation between the utilities and our industry can the need for higher living standards in rural communities be satisfied," Herbert C. Angster, secretary-director of the National Association of Domestic and Farm Pumping Equipment and Allied Products Manufacturers, stated recently.

The association publishes the "Manual of Water Supply Equipment," now in its third edition, and more than 45,000 copies are now in use. "Indicative of the trend toward complete cooperation between the water system industry and the power companies whose lines benefit by the increased load of electrically equipped farms is the fact that 150 public utility companies have requested more than 3,700 copies of the manual," said Mr. Angster.

Manual Has Many Uses

Dealers have made use of the manual to train sales representatives and service men as preparation against the time when warehouses will again be filled with water supply equipment. Wholesalers and manufacturers have used the manual as a guide to give dealers technical training and information.

Published last summer, the 112-page manual contains 21 chapters, constituting an encyclopedia of knowledge on domestic and farm water supply. The text, which is illustrated with 200 line drawings, covers every phase of the sale, selection, installation, and servicing of domestic and farm pumps and water systems.

"The fact that the book was written and edited by a committee representing most of the leading manufacturers in the field is assurance of its accuracy and impartiality," Mr. Angster pointed out. "The members of the committee in charge of the preparation of the manual," he added, "included engineering, service and marketing experts."

In the preface, the authors point out that "the manufacturers sponsoring this manual have dedicated themselves to the single purpose of producing the finest and most efficient water supply equipment it is possible to make."

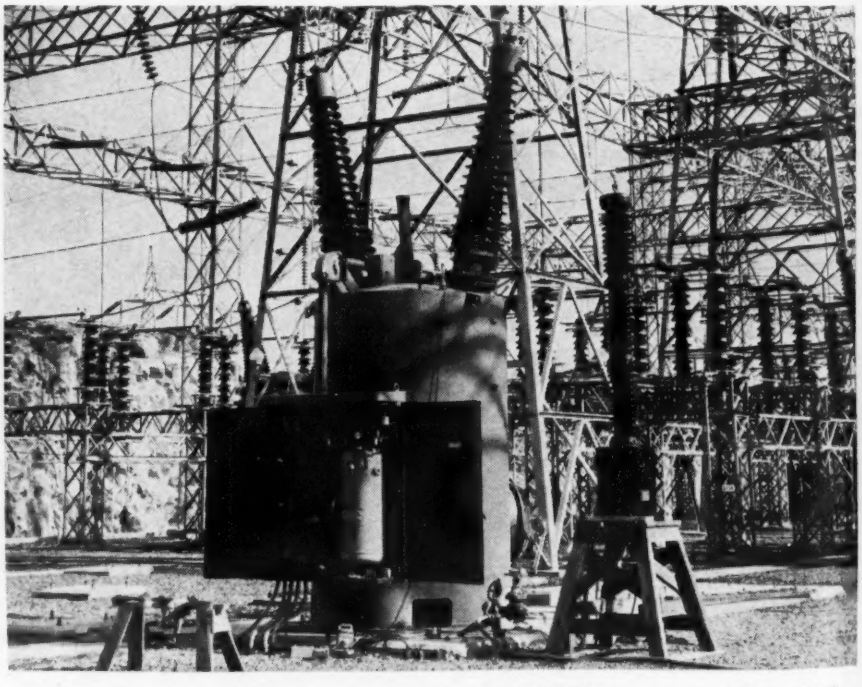
•

Ensemble Selling Adds Sales, Cordiner Tells Retailers

Speaking at the recent annual meeting of the American Retail Federation in Washington, D. C., Ralph J. Cordiner, vice-president of General Electric Co., emphasized the opportunities now open to retailers to increase sales by ensemble selling. By selling a complete kitchen instead of a single appliance as in former years, retailers can now chalk up a sale of anywhere from $800 to $2,500. Similarly, complete home laundries will sell from $500 to $1,500.

Mr. Cordiner also stressed the opportunities for ensemble selling in other rooms of the house. The shortage of domestic servants is making women more and more dependent upon mechanization of home tasks, but Mr. Cordiner cautioned that with greater use of appliances goes greater dependence upon them. Retailers must be prepared, he said, to service these appliances at all hours of the day and night. Only by such round-the-clock service would families be willing to invest the $3,000 to $5,000 that complete mechanization of the home would entail.

Discussion from the floor brought out



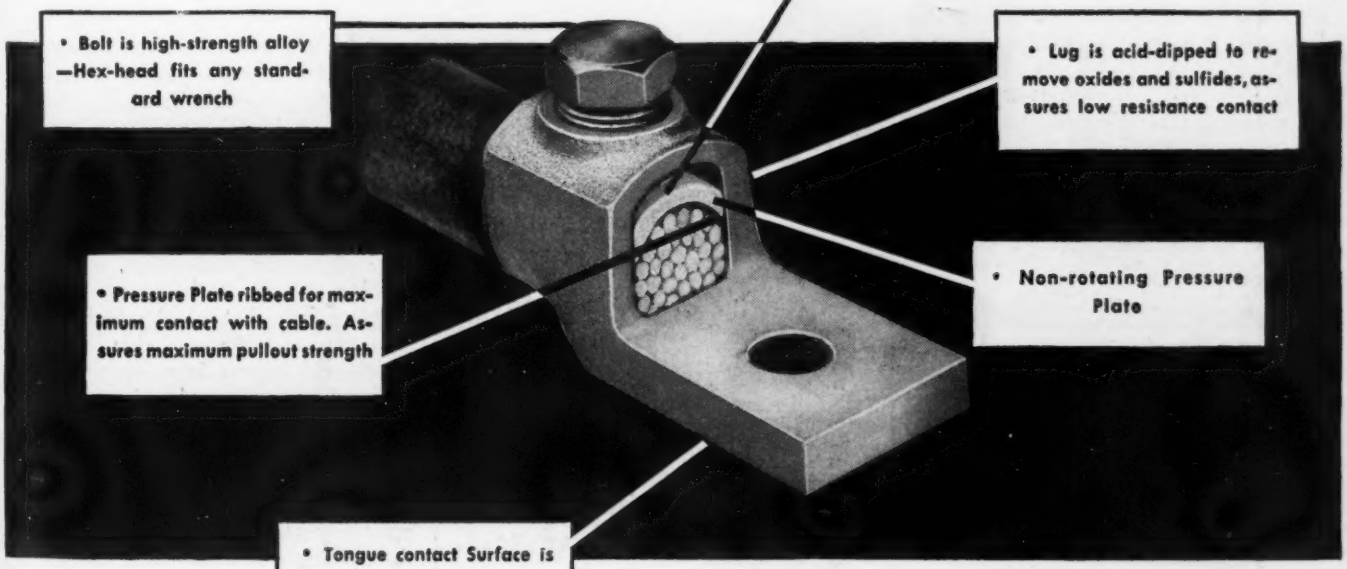
SOME TEST—In a breaker test, approximately 7,500,000 kva. on a 3-phase basis was interrupted by a Westinghouse OCB recently at Grand Coulee. This operation was twice successfully completed within a 15-second period. Utilized was the output of Grand Coulee's six 108,000 kva. generators together with feed back from the Bonneville system and the Northwest power pool over six 230-kva. lines. During the tests, 35 fault operations were made, 12 of which utilized full available capacity. The engineers reported that because of the 3-cycle operation, the disturbance to the system was negligible, and no load was lost

No more loose connections!

O.Z. has this spring steel lock washer here

Only O. Z. has a tin plated Spring Steel Lock Washer in a solderless connector lug! Only O. Z. Connector Lugs can give you such positive insurance against the hazards of loose connections! Superior to washers of "special" alloys, the O. Z. Spring Steel Lock Washer holds its resiliency, exerts greater locking pressure and *maintains* that pressure. Once tight, always tight—if it's O. Z.

O. Z. Solderless Connectors set a standard of superior design. Check these *Additional* Features!


• Bolt is high-strength alloy —Hex-head fits any standard wrench
• Lug is acid-dipped to remove oxides and sulfides, assures low resistance contact
• Pressure Plate ribbed for maximum contact with cable. Assures maximum pullout strength
• Non-rotating Pressure Plate
• Tongue contact Surface is machined for better, low resistance connection

2707

"They're O. K. if they're O. Z."

CONDUIT FITTINGS • CABLE TERMINATORS
CAST IRON BOXES • SOLDERLESS CONNECTORS
GROUNDING DEVICES • POWER CONNECTORS

O.Z. ELECTRICAL MANUFACTURING COMPANY
262 BOND STREET · BROOKLYN, 2 N. Y.

AMPTROL*
...a limit switch manufactured to precision instrument standards by Bendix-Friez. AMPTROL is rated at ½ H.P. Operates with less than 2 oz. differential pressure...actuating travel .003". Contacts are of fine silver. A snap-acting switch that is rugged, compact, dependable.
Write for further details.
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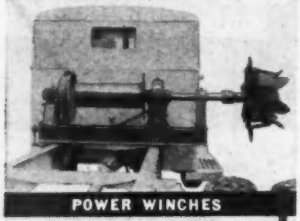
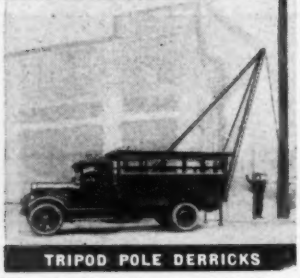
PIONEER MFRS. OF
Truck Winch & Crane Equipment
FOR PUBLIC UTILITIES
OUR 29TH YEAR—1918-1947


POWER WINCHES

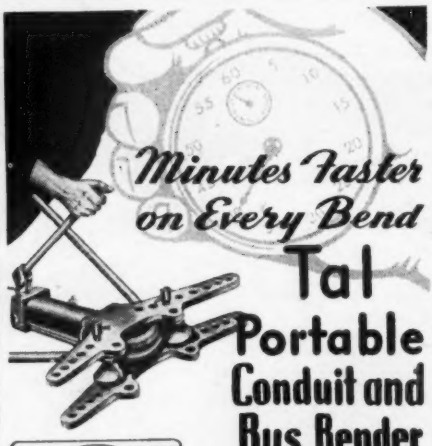

TRIPOD POLE DERRICKS

WINCHES: Capstans; Single and Double Drum, Jaw Clutch, Keyed and Friction Clutch Winches, 2,000 to 50,000 lb. Cap.

POLE SETTING DERRICKS, TOWERS, CRANES, etc.
TYPICAL USERS: AT&T; N. Y. Tel. Co.; T.V.A.; Virginia P. S. Co.; Consolidated Edison Co.; Ohio Power Co.; Texas Power & Light Corp., etc.

Send for Catalog No. 60

THE ORIGINAL SWING BOOM MOBILE CRANE WITH FRONT-WHEEL DRIVE AND REAR-WHEEL STEER
2½, 5, AND 10 TON CAPACITIES
KRANE KAR
TRADE MARK REGISTERED
SILENT HOIST & CRANE CO.
862-63rd ST., BROOKLYN 20, N. Y.


Minutes Faster on Every Bend
Tal Portable Conduit and Bus Bender

Gain time With this best engineered tool.

With an easy-to-operate Tal machine anyone can make perfect, true bends, cold, to any radius up to 90° in one single, uninterrupted operation. There is no need to waste time by replacing the conduit three to six times. Thousands are already in use. Write for illustrated data bulletin.

TAL Prestal Bender, Inc.
Department EW — Milwaukee 2, Wisconsin

the fact that General Electric now has only two-thirds the number of retail outlets it had before the war. Mr. Cordiner said that the company would protect its retailers, but would demand better performance from them.

During further discussion, Mr. Cordiner admitted that retailers' margins on major appliances were now 12-14 percent less than pre-war. He explained that this resulted from the fact that General Electric had kept its price lower than the average for all manufactured products. Some of the cost absorption was taken by the manufacturer; the rest by the wholesaler and retailer. Mr. Cordiner pointed out that retailers are not yet being forced to incur many of the selling expenses on major appliances that were customary before the war. Right now retailers have a ready market, and when the time comes that major appliances have to be sold once again, he hopes that increased productivity at the factory will make it possible to restore pre-war margins.

•

Seal Emphasizes Planning Tomorrow's Lighting Today

"Plan Tomorrow's Lighting Today—Stevens Hotel, Chicago, November 3-7, 1947," proclaims the official seal of the International Lighting Exposition, which is sponsored by the Industrial and Commercial Lighting Equipment Section of the National Electrical Manufacturers Association. "Lighting people, and others interested in the application and utilization of commercial and industrial lighting equipment, will see a great deal of the seal during the coming months," according to E. H. Huerkamp, chairman of the Exposition.

This second Exposition and Conference promises to be an even greater success than that of the first held a year ago. By means of this little seal, which will appear in many of the exhibitors' magazine advertisements and other advertising, we hope to remind everyone who has anything to do with the use, application and sale of lighting equipment that November 3rd is a most important date . . . and that it's the lighting man's date to be in Chicago for the second International Lighting Exposition and Conference," he added.

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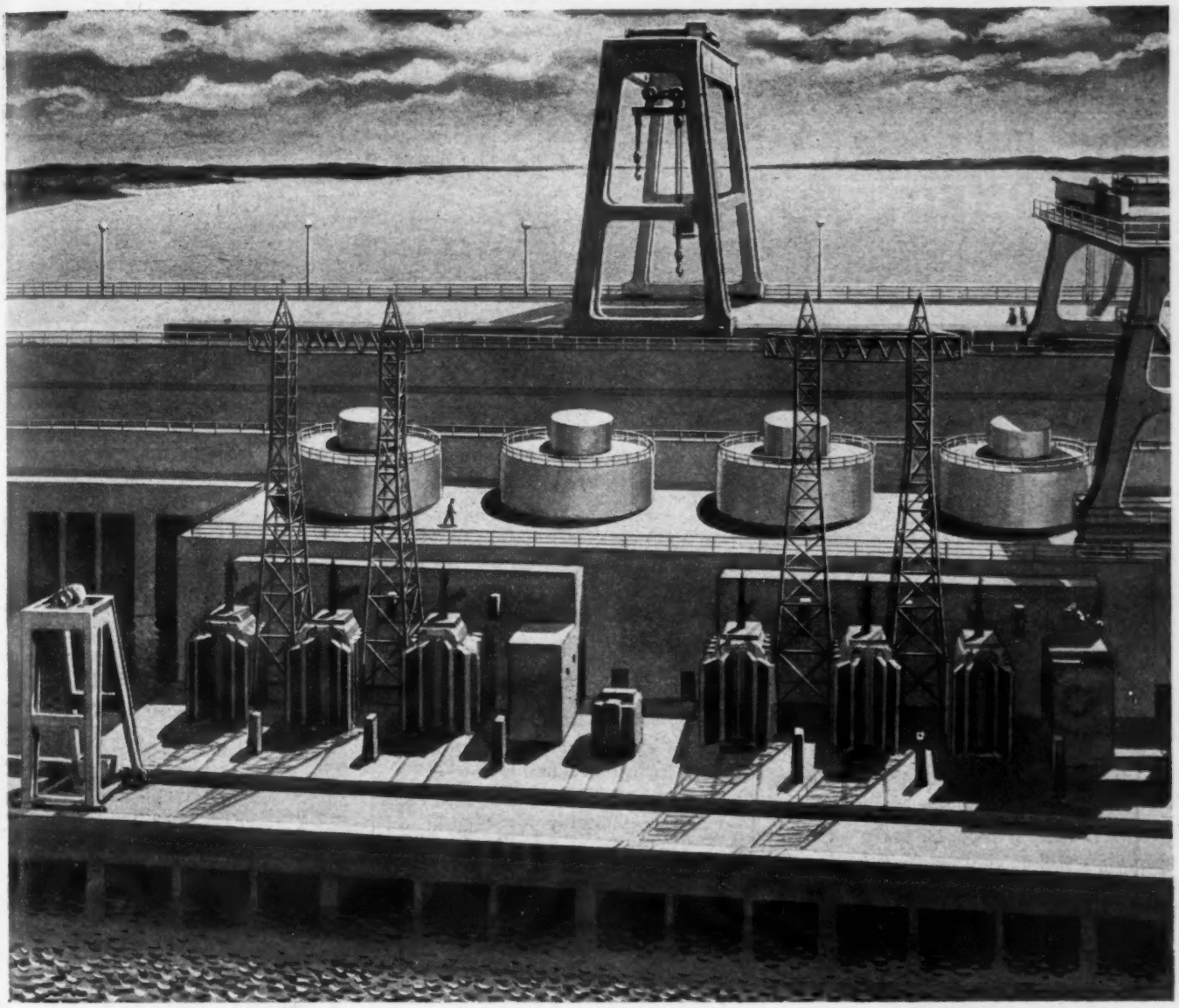
Opens New District Office

Minneapolis-Honeywell Regulator Co. and its industrial division, Brown Instrument Co., Philadelphia, have opened a district office at 27 Halstead St., East Orange, N. J. It will operate under New York branch office direction.



A Type for Every Need . . . A Size for Every Job

BALDWIN HYDRAULIC TURBINES

When your planning on new hydro developments reaches the turbine stage—that's when Baldwin can help.

This Baldwin line of turbines gives you a type and size for every head and every need . . . each backed by records of performance in some of the world's largest installations.

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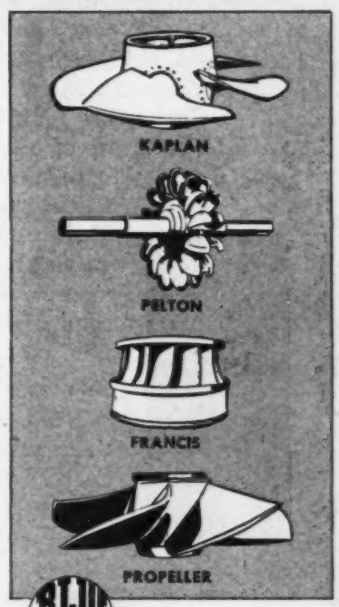

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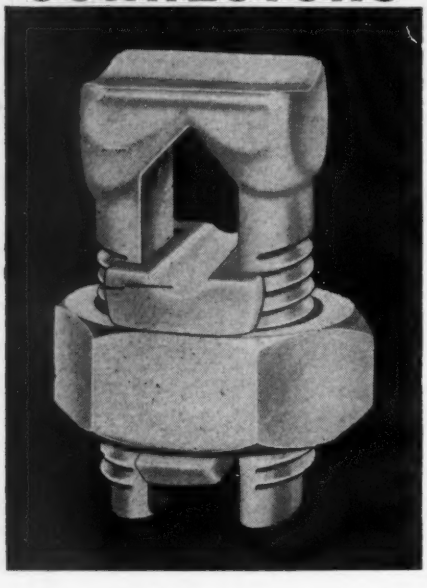
MATTHEWS NUTYPE CONNECTORS



High strength materials and close tolerances of all parts make these connectors exceptionally strong. They will accommodate two or more copper wires from 10 solid or smaller to 1000 MCM strand inclusive. Connectors up to 1/0 strand inclusive, have pure cold forged bolts and clamping jaws and nuts are of 98% copper content hard metal alloy. The 2/0 and 4/0 connectors have machined bolts and nuts of 95% copper content high tensile strength alloy. Connectors for 350 to 1000 MCM strand are of cast hard durable alloy having high conductivity.

Plated connectors for aluminum or steel wires and with bimetallic washers for connection with copper wires are also available.

Nut retainers can be furnished on connectors for 6 solid wire to 1/0 strand inclusive.

Write for Bulletin 206

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House Heating Load

(*Continued from page* 109)

given above) the highest all-service demand was 15.6 kw. of which 11.6 kw. was heating. These demands were recorded from a house that has a total connected load of 47 kw., of which 32 kw. is heating.

It is important to note that with both the central furnaces and unit heaters the highest all-service demand did not occur on the coldest day.

Conclusions Reached

If properly designed, an electric heating installation will be made on the basis of design temperature for the area and heat loss computations. This is a job for an experienced engineer and certainly should not be attempted by a person unfamiliar with heat loss theories and formulas. Since design temperature is a controlling factor, the connected heating load will be in direct proportion to climatic conditions. Consequently, it is felt that connected load can be used as a basis for estimating the demands that will occur in individual homes.

A review of all charts and data collected in the Longview, Seattle and Portland tests reveals the fact that in no instance has a maximum demand for an individual home exceeded 55 percent of the total connected load. Peaks have been found of short duration, not exceeding one hour. Also, it was found that low outside temperatures cannot be used as a basis for predicting peak demands. These points are highly important.

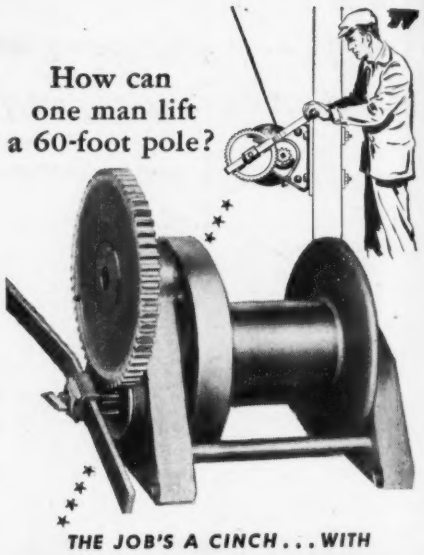
Therefore, it is proposed that the industry work jointly on the following specific points, which it is felt need clarification or additions in the existing National Code:

1. Permit more than one heater unit on a circuit, provided the combined load does not exceed the maximum allowable current capacity of the conductor.

2. Standardize on grounding practice, either that the non-current carrying parts of the heating equipment be ungrounded in non-hazardous locations, or that they shall be grounded.

3. Establish a demand factor or diversity table for determining service entrance capacities in all-electric homes which recognizes the diversity between heating units within a house and the additional diversity between the heating load, range, water heater, lighting and miscellaneous appliances.

How can one man lift a 60-foot pole?



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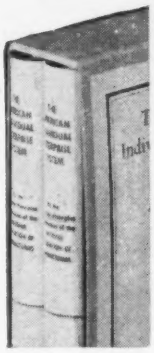

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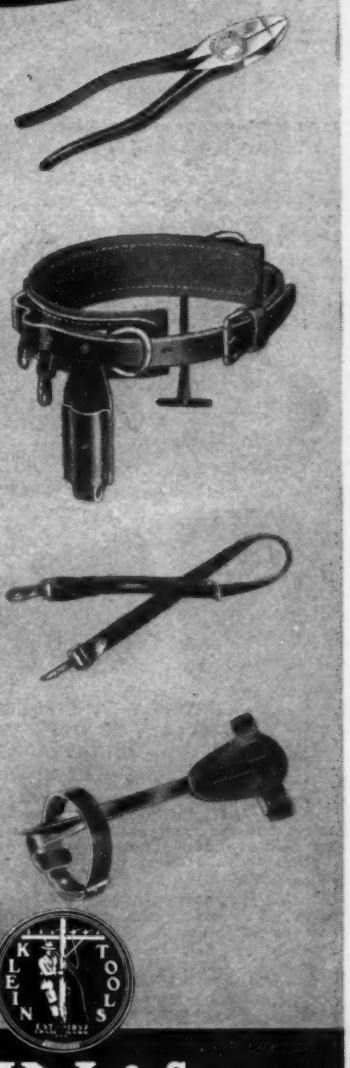

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HOPE (ARK.) LIGHT & WATER DEPARTMENT has reduced its residential electric rate from a flat 3 cents per kw.-hr. to 2 cents per kw.-hr. for all usage over 70 kw.-hr. monthly.

MILFORD (DEL.) MUNICIPAL SYSTEM has increased its electric rates. The new city domestic rates are 8 cents per kw.-hr. for the first 25 kw.-hr. used, 5½ cents for the next 35, 3½ cents for the next 140, 3 cents for the next 200, and 2½ cents for all over 400. Minimum $2. The new rural domestic rates are 10 cents per kw.-hr. for the first 25 kw.-hr. used, 6 cents for the next 35, 4 cents for the next 140, 3½ cents for the next 200, and 3 cents for all over 400. Minimum $2.

•

Manufacturers Announce Plant Expansion Plans

Westinghouse Electric Corp., has turned over to the War Assets Administration a check for $2,058,483 completing the purchase of the plant in Vanport, Beaver County, Pa., operated during the war by the Curtiss-Wright Corp. The new plant will be occupied by the Westinghouse Standard Control Division which has been located in East Pittsburgh, Pa. Employment of approximately 2,000 persons with an annual payroll of $5,000,000 is anticipated when operations are fully under way.

Diamond Wire & Cable Co., Chicago Heights, has opened a plant in Sycamore, Ill., for the manufacture of building wire. This plant will enable this company to manufacture and sell a line of building wires in addition to the flexible cord line it now manufactures at Chicago Heights.

With a view to doubling its present output of power-factor-correction capacitors, Cornell-Dubilier Electric Corp. has started to rebuild one of its warehouses in South Plainfield, N. J., into a modern factory which will provide an additional 40,000 sq. ft. of manufacturing space. The plant, which is being rebuilt at a cost of approximately $150,000, will be equipped with the latest types of conveyor systems. Production is expected to start in the new building within three months.

Jefferson Electric Co., Bellwood, Ill., has purchased the modern plant at Fall River, Mass., used during the war by the Submarine Signal Corp. This new addition was obtained from the War Assets Administration and has a floor area of approximately 250,000 sq. ft. When in full operation it will employ more than 1,200 workers.

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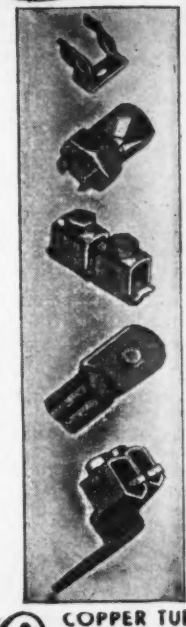

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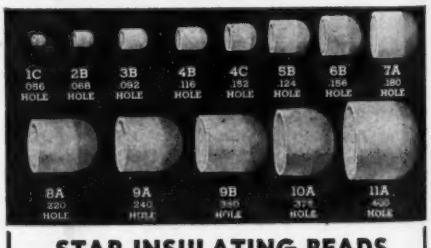

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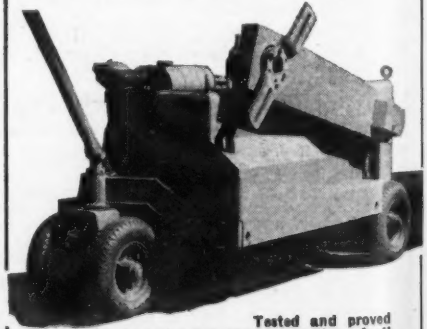

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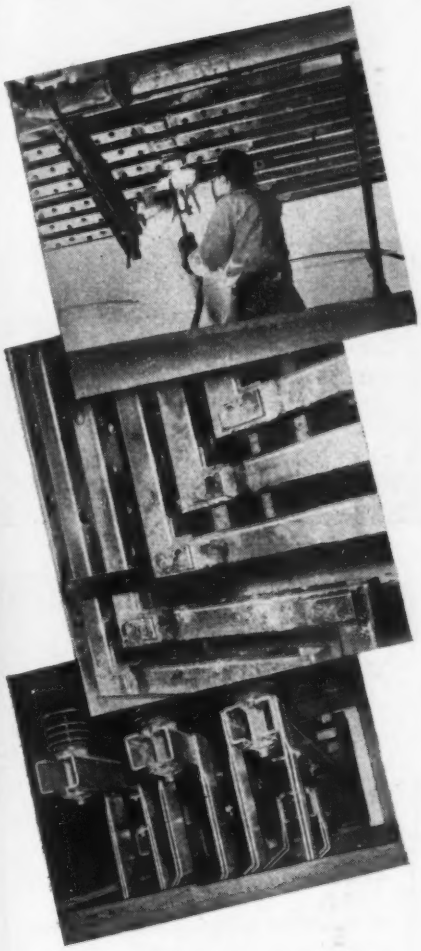

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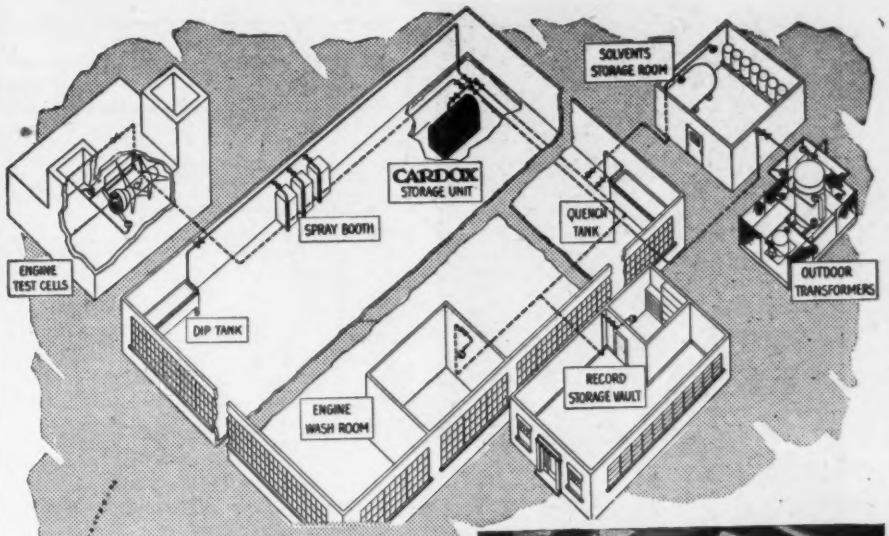

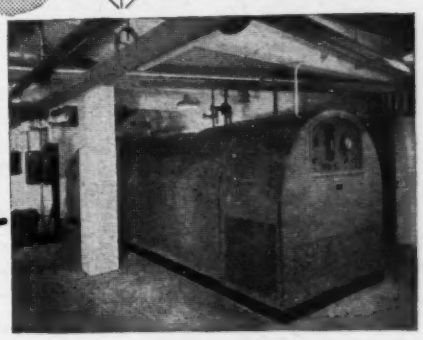

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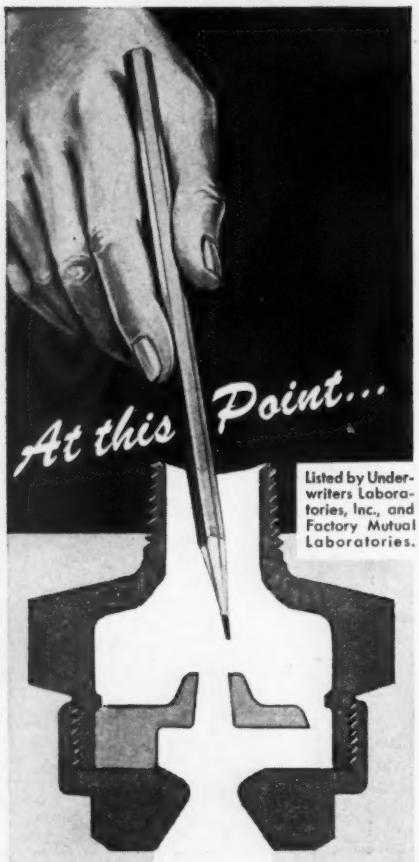

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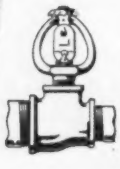

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BOOK REVIEWS

Steam Power Stations. By G. A. Gaffert. Published by McGraw-Hill Book Co., New York, N. Y. 613 pages, illustrated. Price $5.50.

As in the two preceding editions the author has held to the objective of treating the steam plant from the viewpoint of design and construction. All component equipments are analyzed in terms of their thermodynamic contribution, their practical commercial forms and their performance characteristics. Data given for the benefit of the engineering student are of comparable use to the junior engineer delegated to coordinate the plant facilities toward a planned station performance all the way from fuel handling and water treatment to superposition and binary cycles. Closing chapters deal with the economics of generation and of site selection.

The Decibel Notation. By V. V. L. Rao. Published by Chemical Publishing Co., Brooklyn, N. Y. 179 pages, illustrated. Price $3.75.

For the engineer who wants to know in simplest manner about the decibel and its significance, here is an Indian radio engineer's explanation based on nothing more intricate than logarithms. To round out the elucidation there is discussion of thresholds, zero levels, phons and worked-out numercial examples of amplification and other gains. Other uses of decibel covered are in acoustics, receivers, microphone, speakers and filters. The few British terms (aerial, valve, etc.) are no impediment.

Applied Plastic Product Design. By R. L. Davis and R. D. Beck. Published by Prentice-Hall, Inc., New York, N. Y. 285 pages, illustrated. Price $6.00.

While primarily framed for students and plastics engineers, this book has value for the user of plastics, not excluding the electrical user. This follows because the discussion of fabrication difficulties and the techniques devised to circumvent them has value alike for the designing engineer and the engineer who is concerned with both weaknesses and strong points of the fabricated article. There are succinct answers to such questions as flow in the mold, refinement of threads, effects of inserts, permissible taper, appropriate wall thickness, methods of lettering-on, tolerances for tube dimensions, etc. There is also a condensed tabulation of plastic properties and a glossary of terms of the art.

The Home Freezer Handbook. By G. J. Stout. Published by D. Van Nostrand Co., Inc., New York, N. Y. 345 pages, illustrated. Price $3.95.

How to buy or build a home freezer or a farm freezer is coupled here with a wealth of information about planning a home to provide for a freezer if the occupants have a legitimate excuse to have one and how to prepare food for home cold storage (if they justify not buying them frozen). There are data on wastes, shrinkage, annual requirements, packaging and wrapping, disposition in the freezer, idiosyncrasies of various meats and fruits and vegetables, quantities, times, and subsequent thawing for use. This Penn State professor closes his book with a discussion of marketing and distribution of frozen foods.

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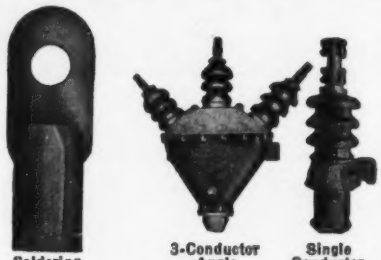

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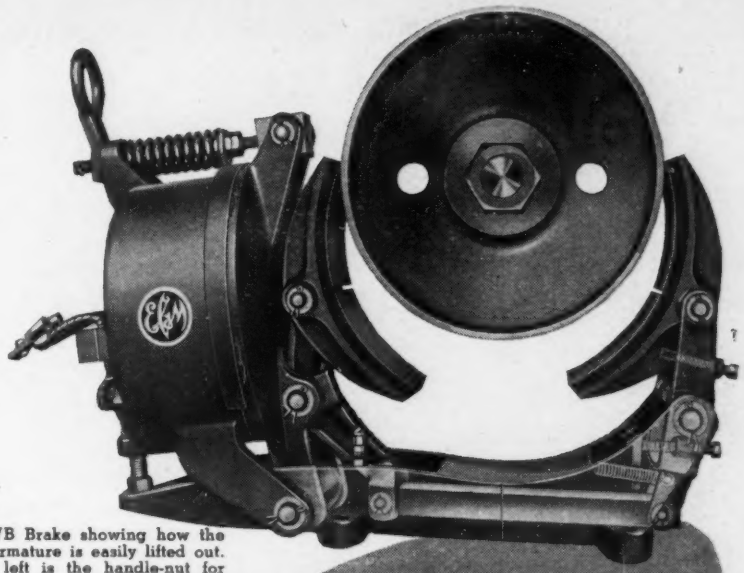

Type WB Brake showing how the motor armature is easily lifted out. At top left is the handle-nut for compressing the spring when removing motor armature, changing brake shoes and for manual control.

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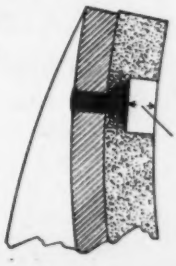

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You can locate ground faults within one span without climbing poles with the Raytron Electronic Fault Locator. Simply energize the circuit from the section break with a capacitor and carry the Raytron Locator along the line. At line intersections or lateral taps the locator meter will tell you which way to drive and point out the fault within one span. The locator will operate up to 100 yards from the line.

The Raytron Method of tracing faults saves many hours locating ground faults on all types of overhead distribution lines. Invisible storm damage, damaged lightning arrestors and other hard-to-locate faults can be found quickly. Not affected by weather.

Get proof that Raytron Locator will locate faults faster and help you restore service sooner. Ask for a demonstration of Raytron Electronic Fault Locator. You will not be obligated. Write Today.

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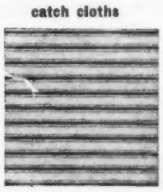

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LETTERS TO THE EDITOR

Submersible Vent for Vault Cutouts

To the Editor of ELECTRICAL WORLD:

A bell vent proposed for oil fuse cutouts installed in manholes which may fill with water was described in ELECTRICAL WORLD, November 23, 1946, Page 98.

We have had many years of experience with this type of vent and, as a result of numerous failures, have discarded it in favor of a completely sealed expansion chamber. We have found that water will be drawn into the cutout from this type of bell in two ways:

First, if there is a fuse operation, the hot gases will be discharged through the bell, and when the gas remaining in the bell, pipe, and cutout cools off, a vacuum will be formed and the water will be drawn up into the cutout. Second, if the cutout is protecting a transformer, as the transformer heats due to loading, pressure will be built up above the oil. This pressure will bleed off through the primary cable into the cutout and out through the bell vent. When the transformer is cooled due to light load, or to the manhole filling with water, a vacuum will form in the transformer and the cable lead to the cutout will transmit the low pressure to the cutout and draw the water through the vent, causing the cutout eventually to fail.

Perhaps it is presumptuous on our part, but we thought it would be most unfortunate if any operating company had to repeat all of our troubles before they learned the fallacies of open cutout venting.

We have approximately 10,000 oil fuse cutouts on our system and closed venting has very materially reduced the failure rate.

J. Arnold Pulsford
Distribution Plant Engineer
Public Service Electric and Gas Co.
Newark, N. J.

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Second Line Ordered

The J. & J. Construction Co. of Oklahoma City has received a $475,165 contract from the Interior Department for construction, within approxmately 13 months, of a 125-mile, 115-kv. transmission line between Phoenix and Tucson, Ariz. The line, the second to be built for the Bureau of Reclamation over the same route, will deliver energy from the Davis Dam power plant to Southeastern Arizona.